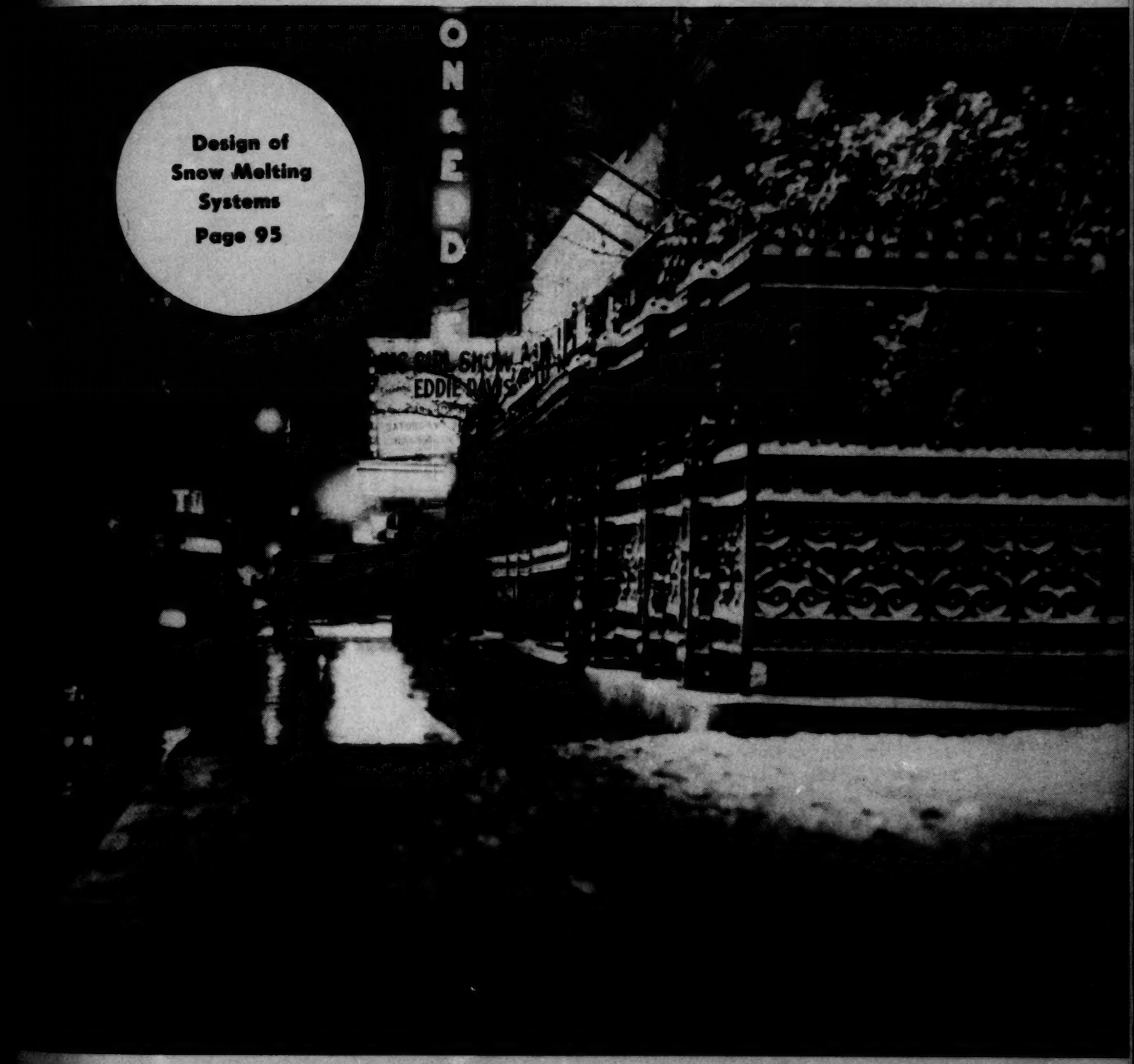
APRIL, 1952

# HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

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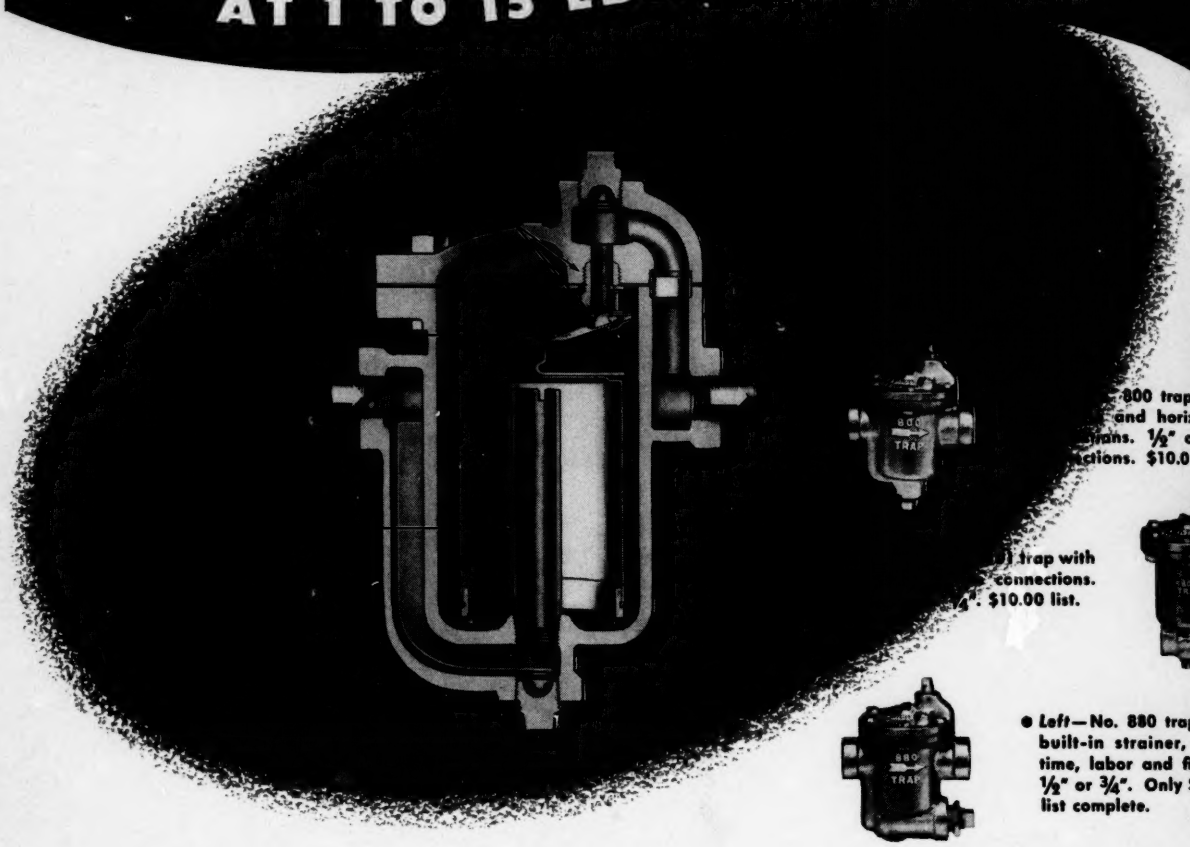
# HOW LONG WILL THIS TRAP LAST AT 1 TO 15 LBS. PRESSURE?



800 trap with and horizontal ans. 1/2" or 3/4" ctions. $10.00 list.

trap with connections. ". $10.00 list.

● *Left*—No. 880 trap with built-in strainer, saves time, labor and fittings. 1/2" or 3/4". Only $11.50 list complete.

HERE'S A TRAP mechanism for low pressures that is identical in design, materials and workmanship to that used in traps for pressures to 950 lbs., temperatures to 900°F.* You know that it will last a LONG TIME with an absolute minimum of maintenance on a low pressure heating system.

**Users report: "4 to 5 years without service"..."10 years—no repairs"... "30% to 50% less maintenance."**

Add to the high quality, low maintenance features of this trap the following benefits: large air handling capacity (blast buckets with auxiliary thermic vents where you need them)... self-scrubbing action... immunity to corrosion... ease of installation—and you have an unbeatable trap for any heating job.

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**The Armstrong Steam Trap Book gives complete catalog information on Armstrong traps, explains trap selection and installation. You are welcome to a copy.**

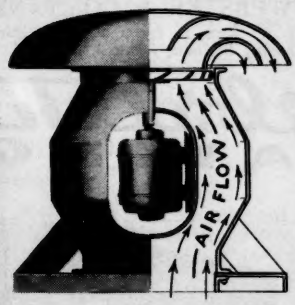
# ARMSTRONG STEAM TRAPS

# Exit Fumes
## FROM NEW INTERCHEMICAL PLANT

12 BIFURCATOR FANS

33 ROOF VENTILATORS

HOW THE BIFURCATOR FAN WORKS




The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing. Corrosive fumes are by-passed around the motor, which is mounted in a separate chamber, open to atmosphere but isolated from exhaust fumes. Bifurcator Roof Ventilators are equipped with weather-proof head and mounting base.

**FREE CATALOG** available on both DeBothezat Bifurcator Fans and Power-Flow Roof Ventilators. Ask your local DeBothezat agent or write the factory, Dept. HV-452.

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EAST MOLINE, ILLINOIS

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*Heated by:*

- Webster Moderator System of Steam Heating
- Webster-Nesbitt Unit Heaters—Propeller-Fan, Giant, Down-Blow
- Webster Walvector along exposed walls
- Webster Drip Traps and Double-Service Valves
- Nash Vacuum Heating Pumps

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There are three basic requirements for effective warehouse heating and Webster Steam Heating Equipment meets all three:

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*In Canada, Darling Brothers, Limited, Montreal*

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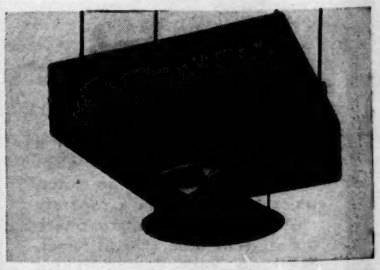
Webster Float and Thermostatic Drip Trap, the standard for Unit Heaters with low-pressure steam.



Webster-Nesbitt Little Giant Down-Blow Unit Heater with cone distributor. Located near ceiling out of the way provides effective heat distribution for any desired temperature in area served.

# HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS



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HEATING & PLUMBING EQUIPMENT NEWS
and technical books.


## THIS MONTH'S COVER

During a snow storm, the 100-ft. sidewalk in front of New York's 21 Club stays clear. Embedded coils of wrought iron pipe circulate anti-freeze mixed with hot water. Photo on cover and on page 95 by A. M. Byers Co.

# Washington News

LORING F. OVERMAN

AT about the time spring was officially ushered in, Washington's NPA division of commercial and industrial refrigeration and air conditioning was reporting that it knew of no instance in which a company under its jurisdiction had closed down because of lack of materials.

This was being accepted by the National Production Authority as a step in the right direction. For only last month, members of the industry's advisory committee had warned of imminent and wholesale shutdowns unless quick steps were taken to provide CMP allotments larger than those initially assigned for first and second quarter production (see page 134). Relatively small amounts of steel, copper and aluminum proved sufficient to alleviate first quarter hardships, informants said.

On the day of the Equinox NPA had not yet announced its supplementary allocations for second quarter use by commercial and industrial refrigeration and air conditioning folks. It was expected, however, that the NPA division concerned would be given a lump allocation for reassignment to manufacturers in a manner reflecting requirements, previous history, and similar experience factors.

### Third Quarter

NPA officials who are studying the supply and requirements picture for the third quarter note that heating, ventilating and air conditioning folks may look forward to an increase of at least 20% in steel, and similarly generous percentages in copper and aluminum. Asked whether this indicates equally favorable progress on the defense program, observers comment that it indicates rather that the third quarter is the one preceding elections—the quarter when Washington will do everything possible to curry voters' favor.

The foregoing increases in supplies, it is explained by observers, are further dependent upon whether there is a steel strike, and whether rumored plans to discontinue the Controlled Materials Plan materialize. The latter possibility, in turn, depends upon whether we continue our defense program on a cold war basis.

### CMP Relaxation?

The idea that CMP may be relaxed will come as a surprise to many who remember that is was imposed only last July amid a fanfare of "must" publicity. Abandonment of the CMP would mean a return of a military-band priorities system, with preference granted only the military and the Atomic Energy commission. It is expected that the priorities could be extended all the way down to the maker of all so-called "B" products which enter into the production of "A", or special military items.

Such a plan would be a return to the original premise that the military is to skim only a limited amount of production off the top of the nation's economy, and that after military needs are met, the civilian goods producers are to be permitted to travel as fast as they can.

It is to be hoped that the plan to relax CMP is not too optimistic. Its realization would mean that the possibility of war is still in the background, but that the threat is not considered sufficiently imminent to tie the entire economy in knots for the purpose of providing needed military items.

As explained on Capitol Hill by iron and steel division spokesmen, first relaxation of CMP would involve steel. Chrome is already excluded from CMP insofar as distribution is concerned, but its production is under the alloy order M-80. A second CMP relaxation would involve secondary mill products. Demand for this type of product has been reduced greatly in recent weeks by the requirement that manufacturers use CMP tickets to make purchases. These products, it is indicated, could well graduate from CMP during the second quarter if all goes well.

Used steel, conversion steel, and merchant trade products would probably be the third class of items moved out from under CMP. Again, the military and Atomic Energy Commission would be allowed priorities, with all others on their own.

Late this year, or during the first quarter of 1953, most shapes of carbon steel should be ready for release from CMP restrictions, the Senate Small Business Committee has been told by CMP Chief William C. Truppner. Tickets would probably be required for the three carbon steel items now in shortest supply—heavy plate, hot-topped carbon bars, and tubing.

### Copper? Aluminum?

There are guessing timetables for copper, aluminum and nickel-bearing steel too—all with imponderables involved.

Aluminum is being eyed for possible decontrol during the first quarter of 1953 unless a water shortage in the Pacific Northwest cuts production as much as 10%.

Copper and nickel bearing steel are slated to be the last to come out from under CMP—and all bets are predicated upon labor peace and no war. In the event either assumption should prove incorrect, decontrol plans would go into reverse, with "the most drastic kind of controls" again necessary.

### Supply Shifts Puzzling

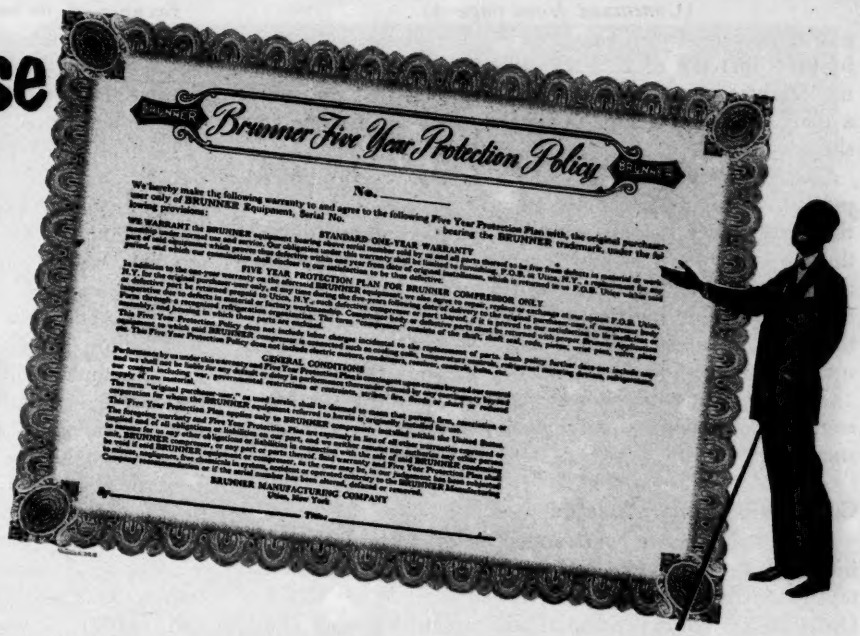
Washington planners seem to be having considerable difficulty in trying to figure out why last month's threat of even greater shortages has suddenly changed into one of possible surpluses. Some explain that the stretch-out of the military program has spread over a longer period the military take of scarce materials.

Others point to the fact that industry, unable to sell all it is producing, has reduced its take of metals. Still others point to the fact that the increase in metals production facilities appears to be catching up with demand.

Still others—of the rugged individualist school—point out that the catchup in supply is merely another proof that individual enterprise, could have taken the military program in its stride, without needing any of the many

(*Continued on page* 6)

# You'll like these EXCLUSIVE SELLING ADVANTAGES!


Brunner Five Year Protection Policy
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We hereby make the following warranty to and agree to the following Five Year Protection Plan with, the original purchaser-user only of BRUNNER Equipment, Serial No. _____, bearing the BRUNNER trademark, under the following provisions:
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GENERAL CONDITIONS
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Hundreds of satisfied customers will vouch for the dependable operation of Brunner air conditioners in all sections of the country. The large number of units sold and the service satisfaction given their buyers is ample evidence that BRUNNER is a line with unusual customer acceptance. When you are known as the Brunner Dealer customers will be *asking you* about Brunner Air Conditioners.

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Self Contained Models in 4 Sizes and in 3 Styles...3, 5, 7½, 10 hp. Capacities.

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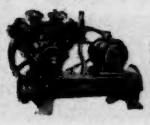
**REFRIGERATION**
Condensing Units from ¼ hp. to 75 hp. 69 Air and Water Cooled Models.



**AIR CONDITIONING**
Self Contained Units to 10 hp. Condensing Units for Remote Installation to 75 hp.

**AIR COMPRESSORS**
Single stage ¼ hp. to 2 hp. Two stage 1½ hp. to 15 hp. Horizontal and Vertical Models.

(*Continued from page* 4)

government controls. They remind the planners that a business increase of 20% or 30% is neither unheard-of nor frightening to American industry, and that creating a giant controls machine to regulate such an increase is sheer nonsense.

The planners' reply, of course, is that an insurance policy is a mighty fine thing to have in case of fire, but that most policy holders would rather pay the premiums than to suffer the loss and inconvenience of a blaze. In this instance, they say, the Korean smoke gave warning of other possible outbreaks. In turn, they say, perhaps the very willingness of the nation to impose controls may be paying off in freedom from spread of the hot war.

Pending a later decision as to which faction is correct, controls continue, and all industry is affected. For instance:

### Construction Orders Relaxed

There are now two construction orders instead of one, but the net effect is to ease building controls rather than to tighten them, as had been threatened. A new NPA Order M-100 covers residential building, with commercial and industrial building covered by a Revised CMP Regulation 6. The latter order replaces a similar CMP order of the same number, as well as NPA Order M-4A, and Direction 1 to CMP Reg. 6. M-4A was the former basic construction order. Direction 1 outlined procedures for self-authorizing small construction projects.

The new CMP Reg. 6 continues its ban on construction for recreational or amusement purposes, but eases up on virtually all other types of projects which are not considered "frivolous." It is expected, for instance, that there will be a green light for virtually all industrial and most commercial building during the third and fourth quarters. CMP officials are announcing this target considerably in advance to allow for early planning. Of particular interest is CMP action in approving new commercial construction projects in seven employment hardship areas. Eighty projects under consideration late in March were in New York City, Boston, Washington, D. C., Portland, Ore., Seattle, San Francisco, and Los Angeles.

Indications were that office buildings, schools, shipping centers and similar commercial construction banned in the past, will be on the green light list soon. Expansion of the construction program will be made possible, CMP spokesmen say, because defense facilities expansion is past its peak.

### Long Range View of Atom

Mention of the atom usually suggests atomic weapons, but a long range view reveals a startling picture. Plants for weapons represent only 11.5 per cent of the total obligations for the atomic energy plan program during the three years starting July 1, 1950. Already the atomic plant facilities account is $2.5 billion—about the same as that of the entire automobile industry, including trucks and parts.

It is almost inconceivable to think that another industry as large as the automotive production plant is being created virtually overnight. Yet the current reports of the Atomic Energy Commission indicate that the plant account is headed for $3.5 billion by July of 1953, and over $6 billion five years later.

Because of its newness, its boldness, and its amazing scope, the atomic energy program should challenge the interest and ingenuity of those who engineer and equip the nation's factories—including commercial and industrial refrigeration and air conditioning.

Perhaps, the AEC folks say, atomic energy is to be the next great industry which will pull the nation's economy up by its bootstraps when the defense program slacks off. The automotive industry served that purpose following the first world war. Radio contributed, and television and aviation have played their parts.

Atomic energy will devote not more than 20% of its $6.4 billion plant to weapons in 1958, the AEC says. The remainder will consist of such general facilities as fissionable materials, reactor development, physical research, biological research, and community facilities associated with the overall program. In estimating the need for residential, commercial and entertainment facilities to serve those employed directly or indirectly in that field, AEC folks point to the experience of the highway transportation industries. Of the nine million persons employed directly or indirectly in highway transportation, only 10% work in plants producing the vehicles, plants, and tires involved. AEC spokesmen are confident that atomic energy projects will be similarly ramified.

Industrial power generation is considered one of the most likely initial applications of the peacetime atom. In 1948 the Atomic Energy Commission said, "We do not see how it would be possible under the most favorable circumstances to have *any considerable portion* of the present power supply of the world replaced by nuclear fuel before the expiration of 20 years." If the expression "any considerable portion" may be taken to mean as much as 20%, its attainment would mean changeovers during the next 16 years at a rate twice as rapid as that of petroleum products and natural gas combined in the United States over the 16 years ended in 1950.

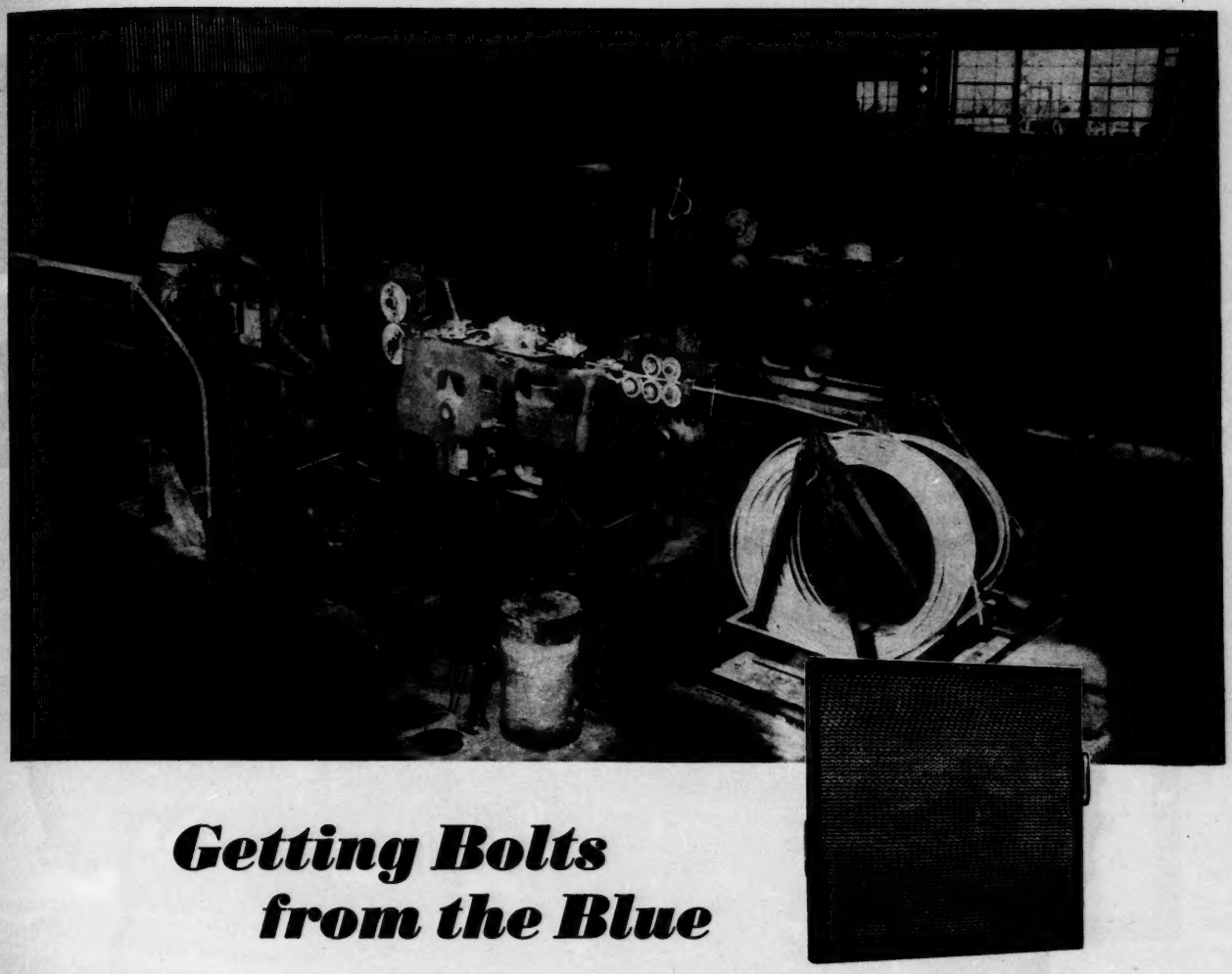
This possibility is mentioned to illustrate the scope of the program, and to focus engineering thought upon its probable imminence.

It must be anticipated that those who engineer and produce heating, ventilating, air conditioning and plumbing equipment will play an important part in the development and operation of the new atomic energy program. Participation will, however, involve a certain amount of original thought and pure research which many firms and individuals will want to initiate while the program is in its formative stage.

Much will come, it is believed, through the employment of isotopes, or "tagged atoms." Initial use was in the field of medicine, but biology and plant studies have followed.

In industry, isotopes have been used experimentally in petroleum production, metallurgy, mining, chemical engineering, synthetic rubber, and other fields. Health and safety in industry are being promised by the use of isotopes, and with the assistance of the the air conditioning engineer. Infiltration of dust vapors in factories and mines, for example, can be traced and measured in workers' lungs and blood streams. This will lead naturally to protective steps which those in our industry will recognize and supply.

To those with an eye to the future, in both war and peace the atom is of growing importance.



# Getting Bolts from the Blue

A large Mid-Western factory* was constantly filled with dense blue smoke generated by the high temperatures and cutting oil from sixty bolt making machines. The complicated and inefficient filtering system used required constant maintenance and allowed heavy oil entrainment into the air ducts.

Upon consultation with Farr Field Engineers, this company installed 2" Type 44 and 2" Type 68 FAR-AIR** filters about 8" apart in the air duct.

Results of this installation were the elimination of oil entrainment, a cut of 80% in maintenance and a 50% reduction in required blower power . . . *plus* substantial savings in simplified duct work. Now, bolts are being made in clean air instead of blue smoke, and this company is finding many more uses for FAR-AIR filters in their factories.

If you have an air filtration problem, consult a Farr field engineer for the proper solution. Write for complete information to Farr Company, P.O. Box 10187, Airport Station, Los Angeles 45, California.

*Name furnished on request

FAR-AIR FILTERS

"Better by Farr"

**Trade Mark Reg.

FARR COMPANY Manufacturing Engineers

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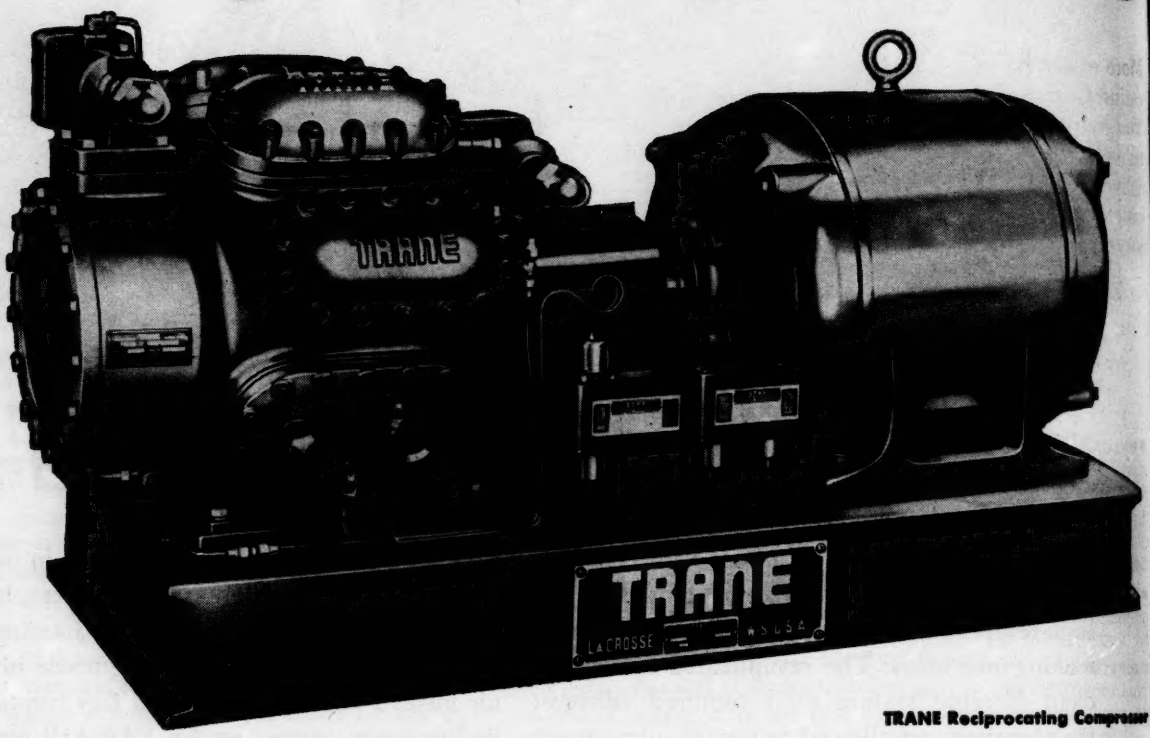
# More proof TRANE great reciprocating

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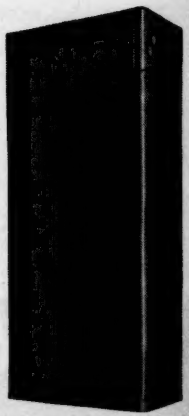
## Complete air conditioning from a single, easy-to-install TRANE unit

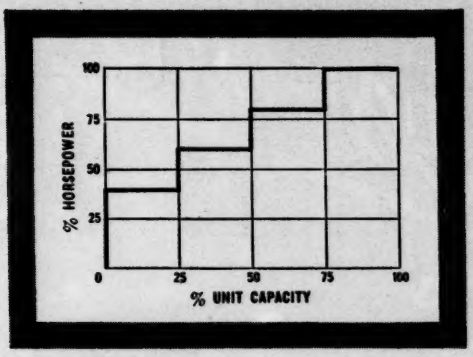
### A MARVEL IN COMPACTNESS!

**TRANE SELF-CONTAINED AIR CONDITIONER.** Here's a year-round air conditioning unit that takes a minimum of space for the job it performs—a boon for stores, restaurants, offices. From 3- to 20-ton sizes, with built-in evaporative condenser optional in 15- and 20-ton models. Easy to install. Heating coil optional. For more information see TRANE Bulletin DS-362 and 362-A.

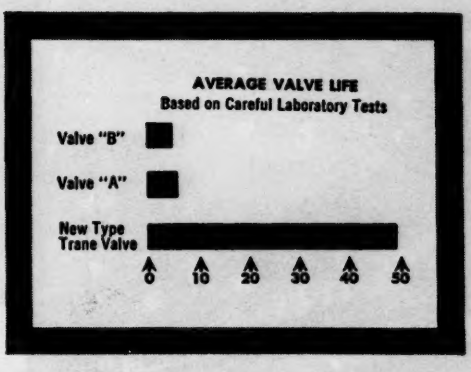


# nakes a compressor!

More evidence appears daily that the new TRANE Reciprocating Compressor is living up to the greatest expectations. You want modern design—TRANE Reciprocating Compressor delivers it! You must have efficient performance—TRANE delivers it! You expect long life, quieter operation, simplified installation and maintenance—TRANE has delivered that too, on the line!



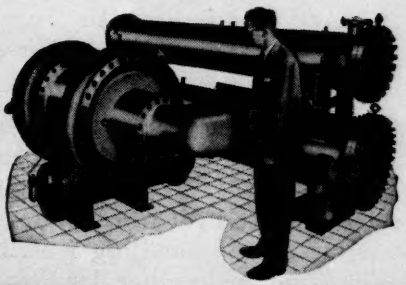

**PROOF: More Power Saving When Loads are Reduced!** TRANE hydraulic cylinder unloader reduces horsepower when cooling load is reduced. It's completely automatic and internal—suction pressure controlled, oil pressure actuated.




**PROOF: More Hours of Operation from Valves!** That's because TRANE ring plate valves have a special surface treatment for long life. Tests prove TRANE valves have up to 8 times the life of other valves tested under the same conditions.

## No other compressor offers all these features!

- **UNLOADED STARTING** . . . permits use of normal torque motor.
- **FOAM BREAKER** . . . reduces loss of oil from crankcase when oil foams from start-up.
- **OIL PRESSURE PROTECTION SWITCH** provides a second guard against lubrication failure.
- **QUIETER OPERATION** because of dynamically balanced construction and direct drive.
- **SIMPLIFIED INSTALLATION** with fewer connections to make on job—it's factory assembled!
- **MODERN DESIGN** with two piston sizes, 2, 4 and 6 cylinders, 10- to 50-ton capacity. Available with shell-and-tube condenser above compressor.
- **SMOOTHER OPERATION** because of carefully balanced lightweight aluminum pistons and connecting rods.



**TRANE CenTraVac.** A complete water-chilling system, hermetically sealed. Capacities as low as 45 tons! Power consumption very closely proportionate to load through entire range. Saves power. Saves money. TRANE Bulletin DS-399 provides complete data.

For FULL INFORMATION about the TRANE Reciprocating Compressor and these other great TRANE refrigeration products, contact the TRANE representative in your area, or write the main office, La Crosse, Wisconsin.

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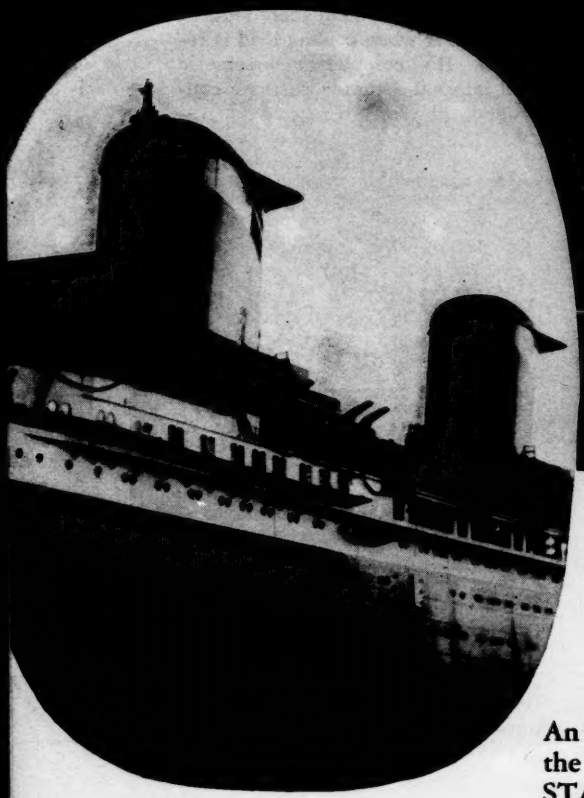
THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd., Toronto
Offices in 80 U. S. and 14 Canadian Cities

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

# Super-liner "UNITED STATES"



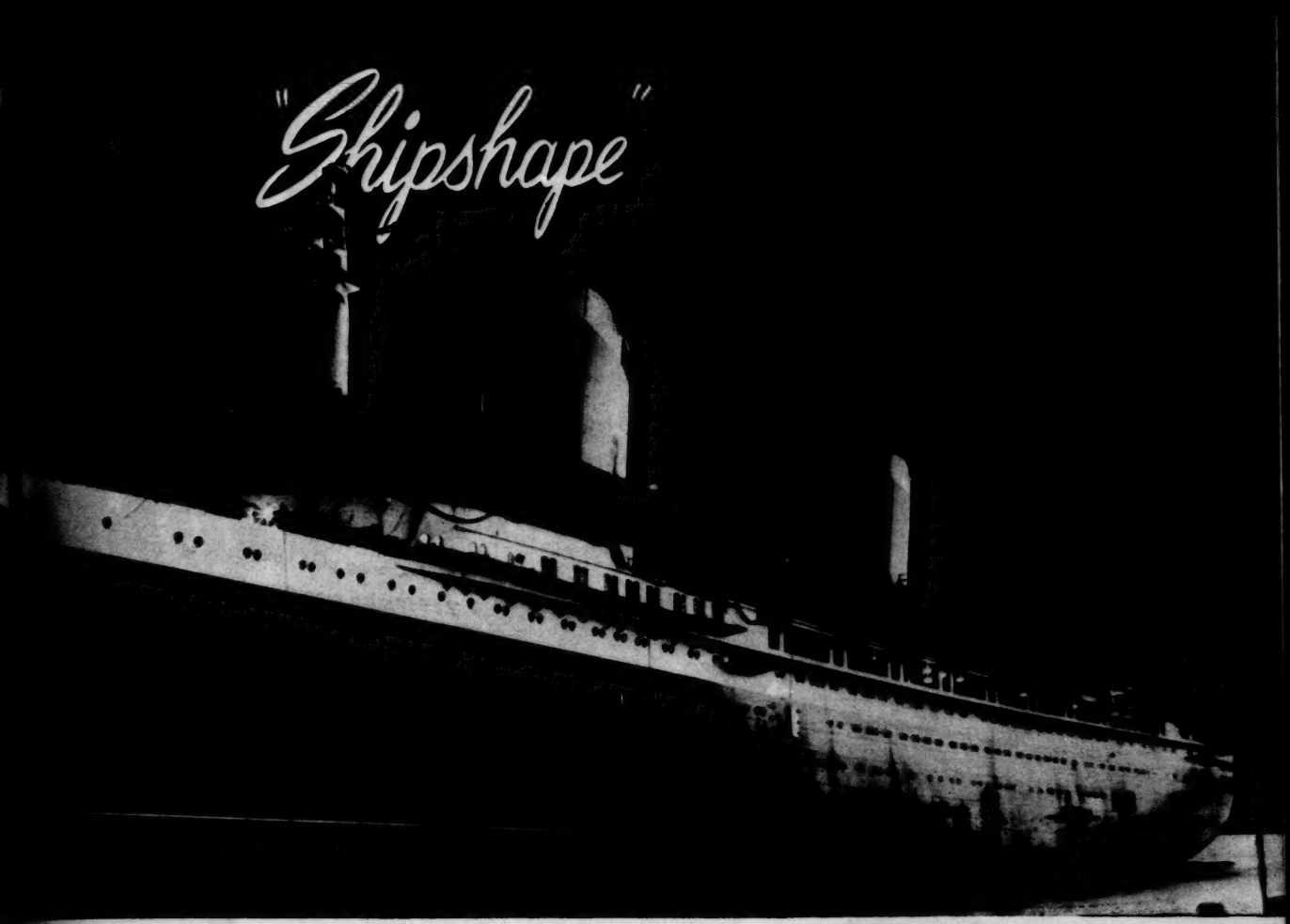
## OVER 200 "Buffalo"

An outstanding fan job — supplying the air handling for the largest American-built liner afloat, the 990-ft. "UNITED STATES"! Stale air is exhausted from entire decks. Machinery spaces, boiler rooms and engine rooms are ventilated. Enormous quantities of air must be supplied for ship-wide air conditioning services. And continuous air supply is needed to operate special Vortex cleaners designed for cinder elimination.

For these important jobs, "Buffalo" Fans were chosen exclusively — hundreds of them. The choice of these compact, durable, high-performance "Buffalo" fans is thoroughly in keeping with the high standards set by United States Lines Company. If *you* are planning an air handling installation, plan it with "Buffalo" fans, the make that leading firms specify.

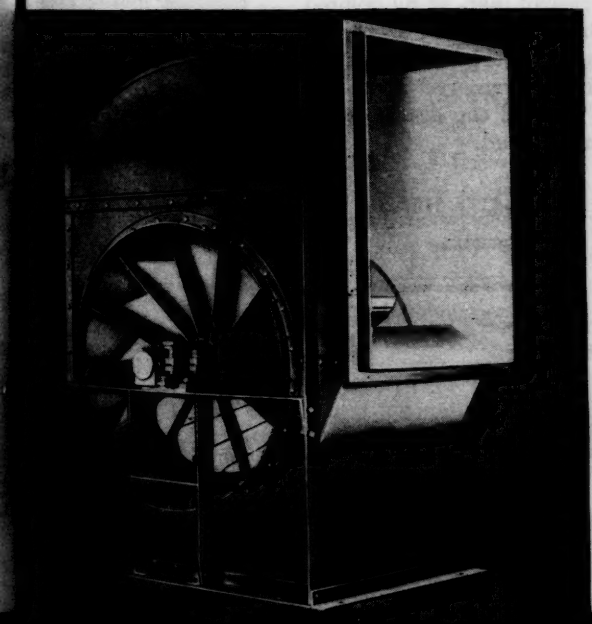
### EXHAUST FANS IN GIANT STACKS

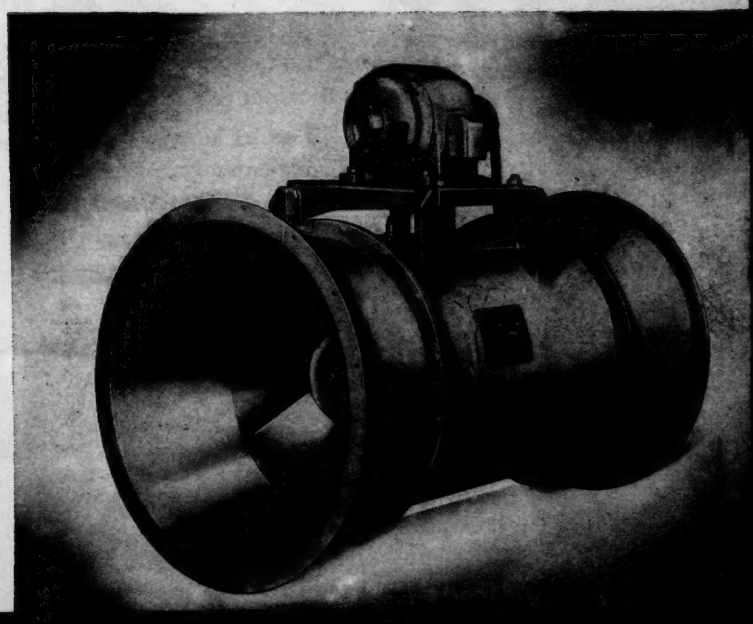
"Buffalo" Type "LL" Fans in the stacks of the UNITED STATES exhaust 90,000 cfm from sport decks, swimming pools, etc., discharging thru the stacks, high above decks.




# FANS ASSURE IT!

The "UNITED STATES" was constructed by
Newport News Shipbuilding & Dry Dock Co.,
Newport News, Virginia.





# NOW!

## *Speeds all these jobs— and many more!*

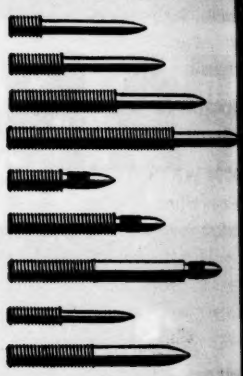
1. Anchoring pipe hangers in concrete.
2. Fastening pipe stanchions in concrete.
3. Hanging instruments to concrete or brick.
4. Anchoring lavatory and laundry fixtures to concrete or steel.
5. Anchoring suspended ceilings, sprinkler systems and lighting fixtures to concrete.
6. Hanging radiator housings to concrete or brick.

## REMINGTON STUDS FOR ANY JOB

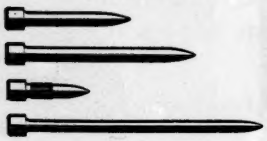
Genuine Remington studs are designed for specific fastening jobs. They are made of special hardened steel alloys permitting pull-out resistance as high as 2 tons, depending on the stud used. These studs were developed by Remington after exhaustive testing for hardness, strength and profile.

Cartridges are available in 5 different power loads, each clearly marked by colored plastic heel caps. These tough heel caps permit instant assembly of any cartridge with any Remington stud. Easily removed from the stud after driving, the heel cap also protects the thread of the driven stud.

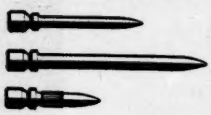
**EXTERNAL THREAD**



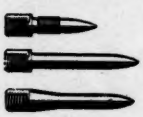
**STANDARD HEAD**



**BREAK-OFF HEAD**

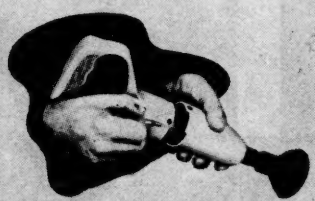


**INTERNAL THREAD**

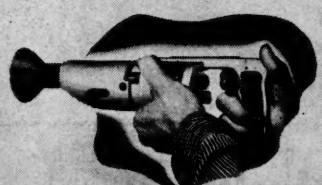


Only Remington studs are identified by this trademark on the head— it's your assurance of safe, dependable fastening.

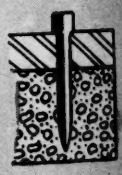
## *It's fast, easy and safe to operate The Remington Stud Driver*



Simply hand-assemble stud and power cartridge, load as a unit in easy-to-open Remington Stud Driver, and close.



Then press loaded Stud Driver firmly against surface, depress safety lever, and pull trigger.



Explosive charge imbeds stud [illegible]. Open Stud Driver with a [illegible] of the wrist, eject empty shell, [illegible] next stud. Whole job takes [illegible]

# Do your construction fastening up to 100 times faster with the

## NEW CARTRIDGE-POWERED MODEL 450

# REMINGTON STUD DRIVER

# and do it safely!

### LOOK AT ALL THESE FEATURES

**COMPACT AND PORTABLE**—Weighs only 5½ pounds, ideal for scaffold, ladder, overhead work, inaccessible places. Comfortable to use in any position.

**SPEED**—One man can set up to 5 studs per minute, as much as 100 times faster than other methods. Sets stud at whatever depth is required up to 2¾ inches, depending on material.

**ELIMINATES INVESTMENT** in outside power source—self-powered. Especially useful in isolated places.

**FOUR WAYS SAFE**—Plainly visible red dot indicator shows when it's cocked; safety lever must be depressed before and during squeezing of main trigger; permanently attached safety shield must be compressed against work before Stud Driver will operate. Stud Driver will not operate if tilted at more than a slight angle. Slight recoil. Low noise level.

**RUGGED**—All working parts of the Stud Driver are made of heat-treated alloy steels, housing of strong, light weight aluminum that carries no operating stress. Lining of safety shield is a solid block of tough, resilient Du Pont neoprene.

**PRICE** for Model 450 Remington Stud Driver complete in rugged steel carrying case—only $119.50.

### Firmly fastens steel or wood to concrete or steel *in seconds!*

With the amazing new Remington Stud Driver you can set fastening studs up to 100 times faster than with conventional methods . . . and cut costs, too. This revolutionary fastening tool easily sets as high as 5 studs per minute . . . with no outside power source—no other equipment needed!

Easy to operate, the Remington Stud Driver weighs only 5½ pounds. It's compact, rugged and safe! With one lightning-fast operation, this self-powered tool firmly fastens steel or wood structural pieces and fittings to concrete or steel surfaces . . . a squeeze of the trigger and the job is done!

Test-proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., *America's oldest and foremost sporting arms manufacturer.* To obtain detailed information on this time- and money-saving tool, and for the name of your nearest distributor, fill out and mail the coupon below.

*"If It's Remington—It's Right!"*

**Remington**

DU PONT

**Remington Arms Company, Inc.**
**Industrial Sales Division, Dept HV-4**
**939 Barnum Ave., Bridgeport 2, Connecticut**

I am interested in obtaining descriptive literature on the Model 450 Remington Stud Driver.

*Name*_____

*Firm*_____

*Position*_____

*Address*_____

*City*_____ *State*_____

*"Word's gotten around—we insisted on Honeywell controls"*

From the length of that line, looks like Cartoonist Larry Reynolds' builders won't have any trouble filling their new office building!

And, judging from their practical approach to the problem of temperature control, space in their new building *should* be highly desirable. These prospective tenants know from past experience, as do many heating engineers and contractors, that insisting on Honeywell controls always results in *better* temperature control.

If *you* have a control problem, Honeywell can help you provide the proper thermal environment for any client—anywhere—in any kind of structure.

A large staff of expert control engineers—in 91 different Honeywell offices across the nation—specialize in doing just that. Also—there's a lot of literature that's yours for the asking—on the automatic control of heating, ventilating and air conditioning in any type of building.

So why not talk to Honeywell? Why not write to Honeywell about your control problem? And why not do it *now?*

Honeywell controls are available for all buildings—large, small, commercial or residential. See the facing page which gives interesting facts about some of these fine Honeywell controls.

H HONEYWELL *For help with any control problem, talk to Honeywell*

*for increased efficiency of pneumatic heating, ventilating or air conditioning controls*

# specify Honeywell Gradutrol Systems

with the GRADUTROL RELAY–Honeywell's exclusive positive-positioning device for damper motors and valves

THIS fine relay offers you important plus features that help increase the efficiency and economy of heating, ventilating and air conditioning systems.

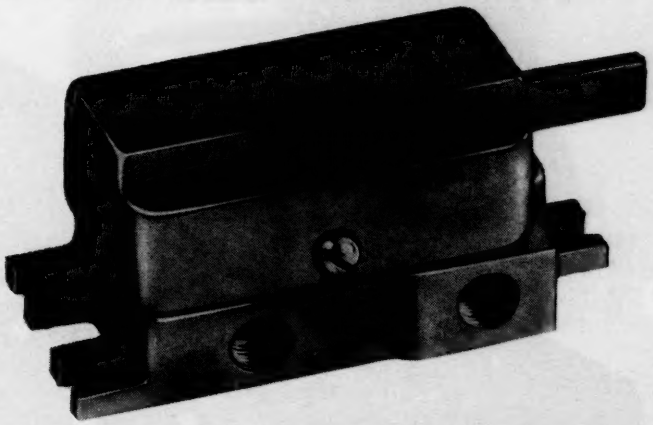
First, this Gradutrol Relay provides *true positive-positioning* of valve or damper because it has the *full power of the motor available at all times.* This allows a large number of positions between the open and closed position.

*Smoother operation* is another extra! "Jumpy" valve and motor starts, due to friction or pressure, are virtually eliminated by the Gradutrol Relay.

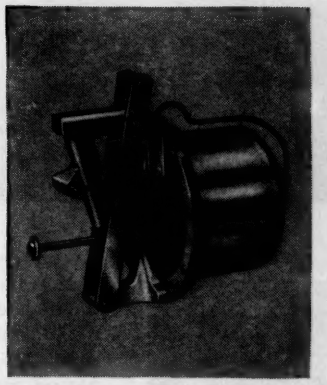
*Maintenance is reduced* because the "full power" feature of the Gradutrol Relay permits accurate operation of damper even under sticky or rusty conditions.

*Economical sequencing* of valves or motors is easier to attain for the Honeywell Gradutrol Relay provides a *complete range of air pressure adjustment* in relation to the controller.

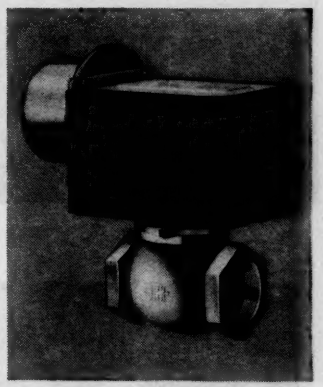
You can also improve the efficiency of existing systems by adding this dependable, accurate Honeywell Gradutrol Relay. So whether you're concerned with a new installation or modernizing an old one, be sure you give your clients the plus operating advantages this Honeywell Gradutrol system offers. For additional facts, call your local Honeywell office or mail the coupon below.



*R094 Gradutrol Relay, the heart of Honeywell's Gradutrol system, gives true graduation to damper motors or valves.*



*M0900 Grad-U-Motor, and R094 Gradutrol Relay–highly efficient combination for controlling dampers. Exclusive "positive-positioning" feature reduces "lag"–eliminates "overshoot."*



*K0900 Gradutrol Valve, including R094 Gradutrol Relay–a feature of this team is the highly efficient sequencing possible. Ideal for modernizing present control installations.*

MINNEAPOLIS **Honeywell**

First in Controls

*Word's gotten around–that for help with temperature controls, we talked to (your firm name)*

**FREE!** Personalized cartoon. For your 8½" x 9" reproduction of this Reynolds cartoon (incorporating your name or the name of your firm), fill out and mail coupon today.

**MINNEAPOLIS-HONEYWELL REGULATOR CO.**
**Dept. HV-4-90, Minneapolis 8, Minnesota**
**Gentlemen:**

☐ **I would like more information on your Gradutrol System of pneumatic controls.**

☐ **Please send me a free, personalized reproduction of the Reynolds cartoon, inscribed with this name:** _____

**Name** _____

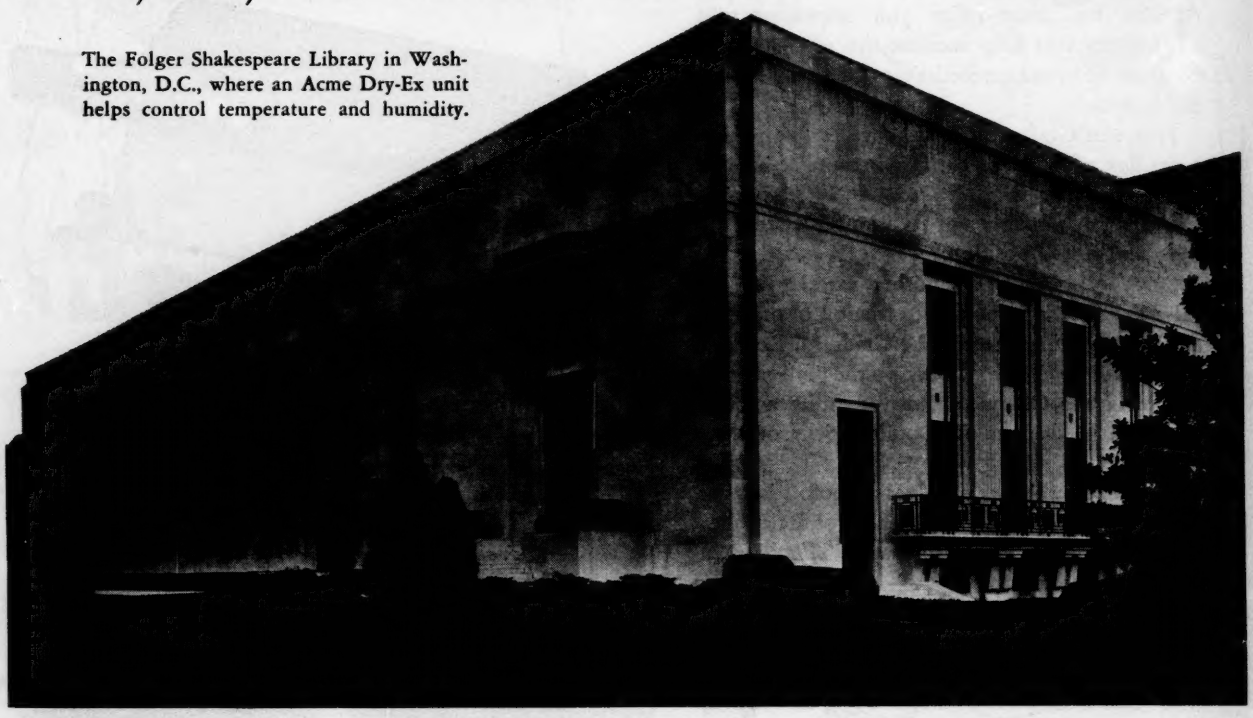
**Firm Name** _____

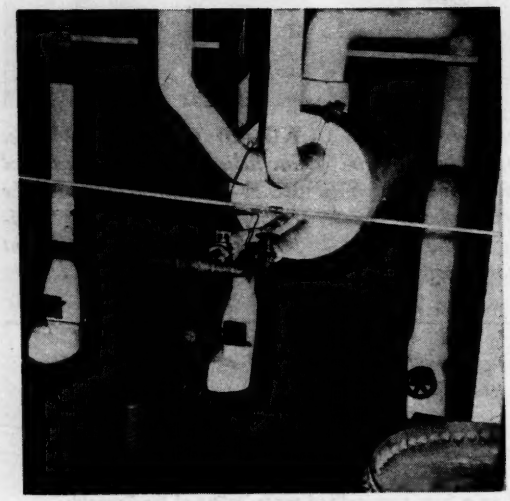
**Address** _____

**City** _____ **Zone** _____ **State** _____

# Acme DRY-EX CHILLER
## helps safeguard
# $10,000,000 SHAKESPEAREAN COLLECTION

The Folger Shakespeare Library in Washington, D.C., where an Acme Dry-Ex unit helps control temperature and humidity.





The Acme Dry-Ex Chiller installed at the Folger Library.

Extremely close year-round control of temperature and humidity is necessary for the protection and preservation of aged parchments and papers. The trustees of the Folger Shakespeare Library in Washington, D. C., recognized this fact in connection with their $10,000,000 collection of literature of the Shakespearean period including 79 of the first folios. The history of Western civilization for the 200 years before 1700 is completely recorded in this collection — one of the greatest in the Western Hemisphere.

The thousands of volumes are located in vaults and rooms spread all over the large building. One room is a full size replica of a 17th century theater. It seats about 200 people and at times has performances held in it. Such variations in space, distance and occupancy placed a heavy load on any air conditioning system installed.

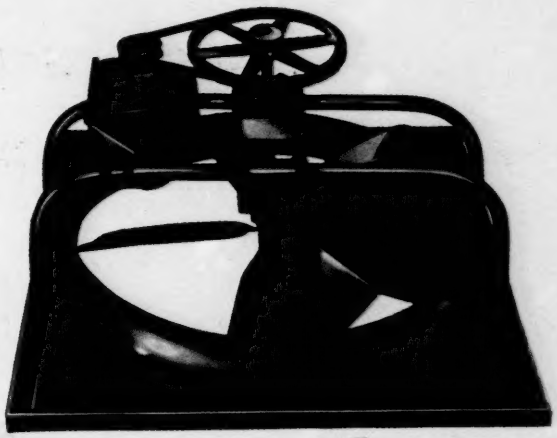
The installation finally decided upon was engineered and designed by the Griffith Consumers Company. It is a 100-ton chilled water air conditioning system that has as one of its component parts a 20″ by 14′ Acme Dry-Ex Water chiller. This unit was selected for its easy adaptability to variable loads and for its life-long assured, dependable performance.

**ACME INDUSTRIES, INC.**
FLOW COLD DIVISION
**Jackson, Michigan**

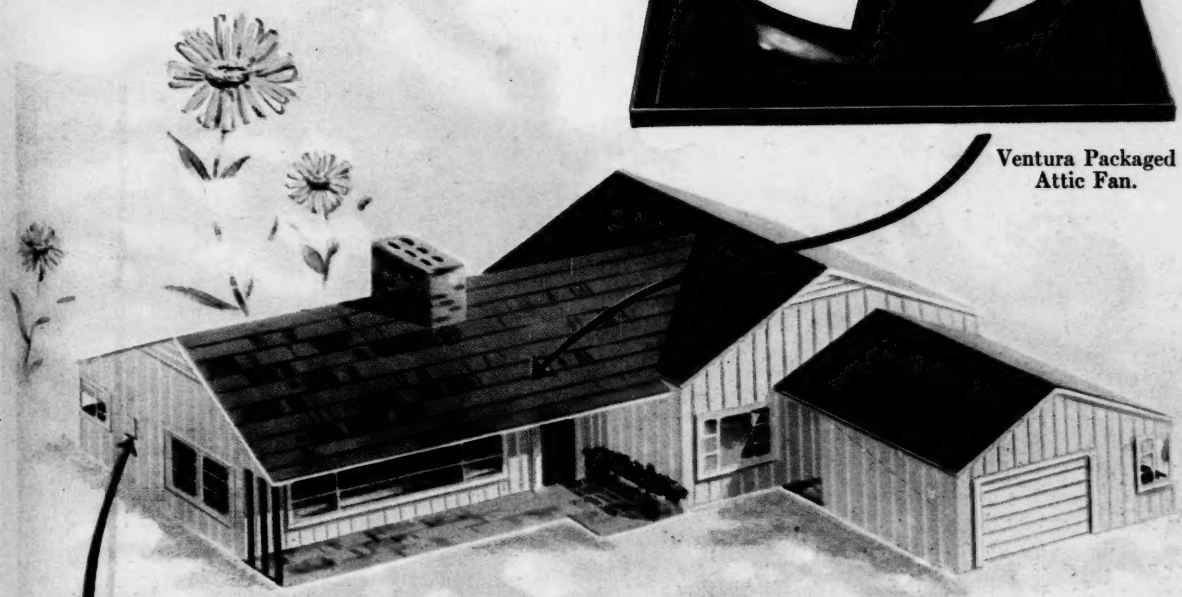
ACME PRODUCTS

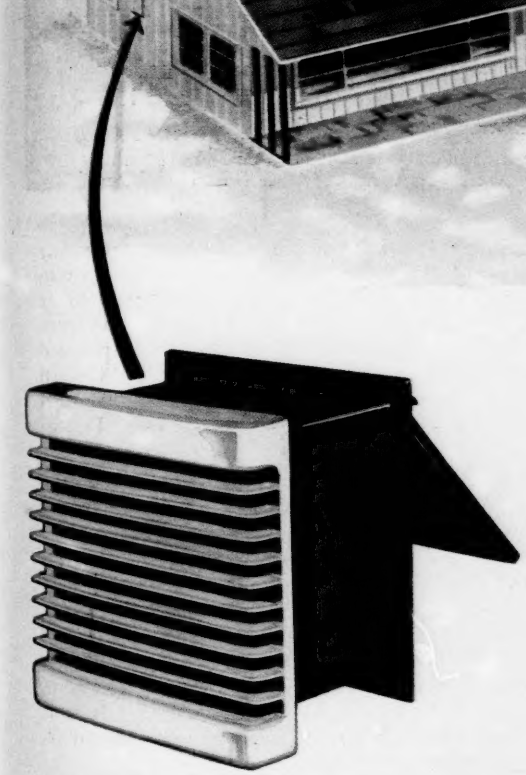
*CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRIES SINCE 1919*

**American Blower – a time-honored name in air handling**



Ventura Packaged Attic Fan.





Aeropel Home Ventilator. Winner of two Fine Art Awards for beauty and utility.

Homes will be cooler, more pleasant and more comfortable when equipped with quiet-operating and efficient American Blower Ventilating Fans.

American Blower Attic Fans exhaust the pent-up daytime heat of attic and house—draw in a refreshing breeze of nature-conditioned night air.

American Blower Aeropel Fans whisk out offensive smoke, fumes and odors, maintain a fresh-as-a-daisy atmosphere in kitchens and other rooms, all year round.

The added comfort of a well-ventilated home is well worth the reasonable price and low operating cost of American Blower Home Ventilating equipment.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

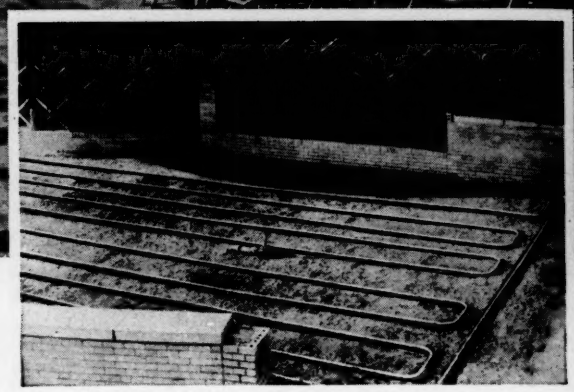
Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

# AMERICAN BLOWER

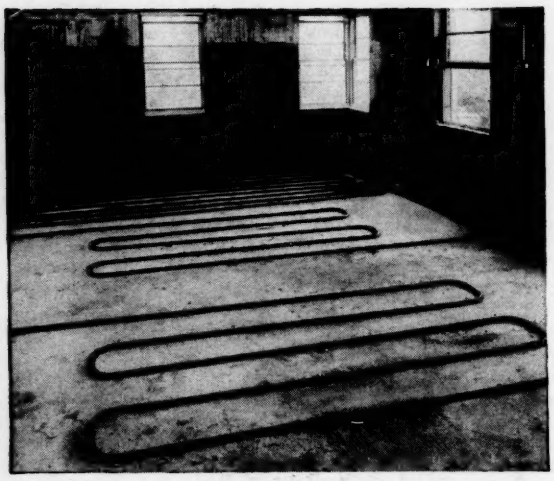
YOUR BEST BUY IN AIR HANDLING EQUIPMENT

*Serving home and industry*

# Convalescents now more comfortable...



## with radiant heating and snow melting



● You'll look a long time before you find a building more ideally suited to the needs of the convalescent. It's the Brooklyn Jewish Home for Convalescents in Far Rockaway, N. Y.

They used 27 tons of National Steel Pipe for the radiant heating and snow melting installation. Every room has radiant heat—the ideal heating system for the aged and the ill.

To make full use of the terrace year round, a snow melting system was installed using National Steel Pipe. Now, patients can utilize the sun-bathed terrace in all but the very worst weather.

National Steel Pipe has been used for many radiant heating systems in homes, institutions and industrial plants. The pipe is made to the same rigid standards that have made National the preferred pipe for conventional heating for over *60 years*.

If you have any questions regarding pipe for radiant heating or snow melting, make use of our wide experience. We think we'll be able to help you.

NATIONAL TUBE DIVISION, UNITED STATES STEEL COMPANY, PITTSBURGH, PA.
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

**U·S·S NATIONAL Steel PIPE**

USS

UNITED STATES STEEL

# with kno·draft adjustable air diffusers

Keep customers comfortable and department store sales go up. That's been proved time and again. So, in the new Southtown store of Famous-Barr Co., St. Louis, you'll find Kno-Draft *Adjustable* Air Diffusers.

Kno-Draft *Adjustable* Air Diffusers can be set for exact control of both volume and direction of air flow. This means even distribution of heat, *without drafts*, throughout the conditioned area. And because they are adjustable *after* installation, it's no trouble to vary the air pattern when changed conditions call for it. This feature also eliminates much preliminary figuring by engineers and installers — makes a foolproof system.

Note, too, the handsome appearance of Kno-Draft *Adjustable* Air Diffusers. They are as unobtrusive as they are efficient — go with any surroundings, either in their natural spun metal finish or painted to match the ceiling. There are types and sizes to meet every need. Mail the coupon for full information today.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

**W.B.CONNOR ENGINEERING CORP**
Danbury, Connecticut
*Air Diffusion • Air Purification • Air Recovery*
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

**W. B. CONNOR ENGINEERING CORP.**
**Dept. J-42, Danbury, Connecticut**
Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

**Name**.....
**Position**.....
**Company**.....
**Street**.....
**City**.....**Zone**.....**State**.....

. . . and no wonder. AGITAIR Type R is the only diffuser to assure 100% air distribution in any shape area . . . from any location . . . without blank-offs or oversized outlets. Tailor-made for each application.

*Write for Complete Data*

**Air Devices Inc.**

17 East 42nd St. • New York 17, N. Y.

Air Diffusers • Air and Grease Filters • Exhausters

ANOTHER EXAMPLE OF VERSATILITY..

# DRAVO *Counterflo* HEATERS*

## SERVE BUFFALO TRANSIT COMPANY IN 3-WAYS

*DIRECT-FIRED

1. **COMFORT HEATING**—in winter. Four Dravo Heaters recirculate warm air over a 33,600 sq. ft. floor area in three integrated buildings . . . each heater has maximum air throw . . . provides uniform heat for personnel at working levels, despite opening and closing of doors to permit buses to enter and leave.

2. **VENTILATING**—in summer. Heater fans can be used alone to recirculate air and keep working conditions comfortable in hot weather. The Dravo Heaters are mounted horizontally and suspended from roof trusses to save valuable floor space.

3. **DRYING**—all year 'round. One heater, in addition to these other functions, dries buses with warm air as they come off the wash rack.

## DRAVO HEATERS OFFER YOU...

- **Low initial cost**—users report savings of 30% to 60% over standard "wet-type" systems.
- **Easy installation**—no duct work . . . need only fuel, exhaust and electrical connections.
- **Low operating cost**—burns gas or oil . . . easily converted . . . minimum efficiency 80%.
- **Long life — low maintenance**—rugged construction . . . stainless steel combustion chamber eliminates refractory lining.
- **Heat where you need it**—right in the working zone . . . roof heat losses reduced.
- **Automatic operation**—heater looks after itself . . . requires only occasional attention.

**MAIL THIS COUPON FOR MORE INFORMATION...**

Heating Department, Dravo Corporation
Dravo Building, Fifth and Liberty Avenues
Pittsburgh 22, Penna.

I would like more information about Dravo Counterflo Heaters. Please send me Bulletin No. UV-526-243

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

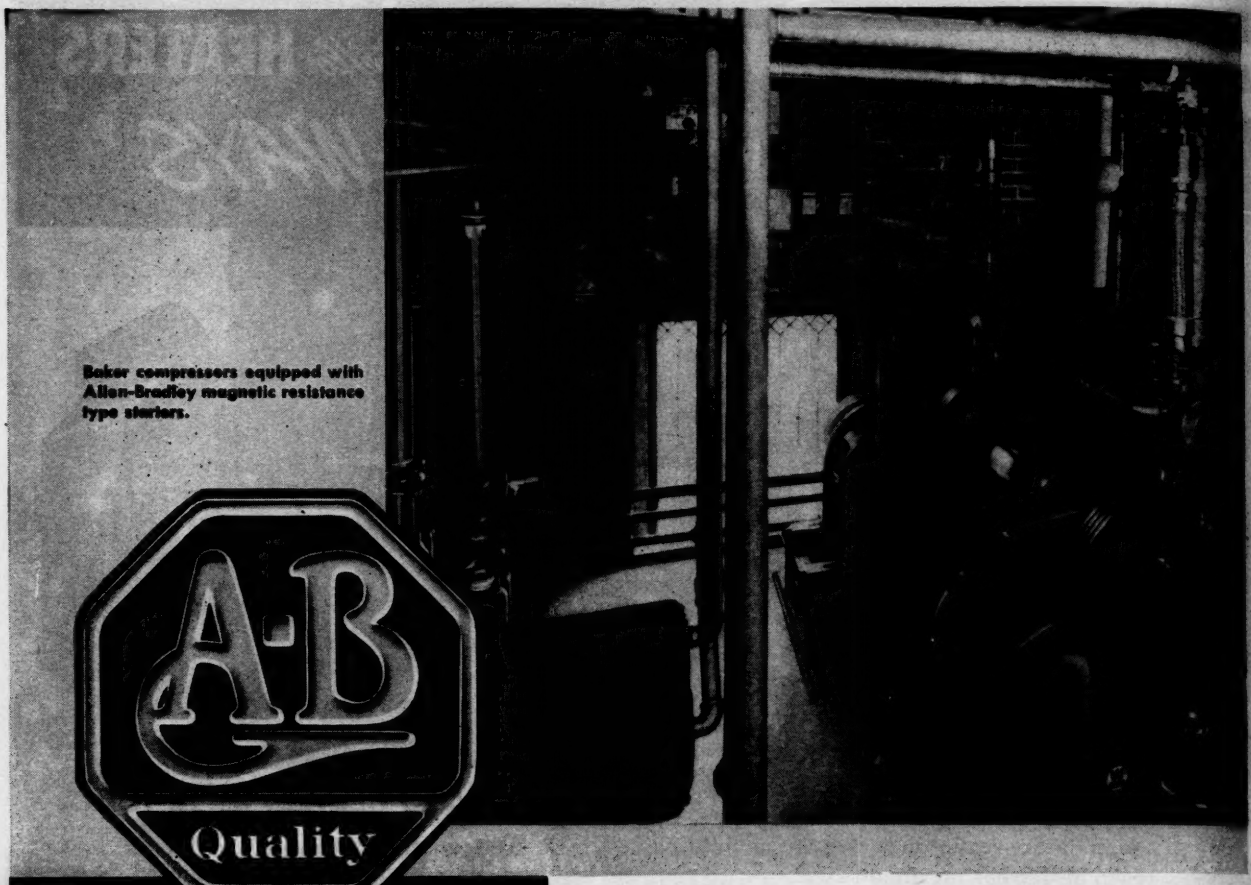
# DRAVO

CORPORATION

PITTSBURGH • ATLANTA • BOSTON • CHICAGO • CLEVELAND
DETROIT • NEW YORK • PHILADELPHIA

*Sales Representatives in Principal Cities*

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec. Export Associates: Lynch, Wilde & Co., Washington 9, D.C.



Baker compressors equipped with Allen-Bradley magnetic resistance type starters.

A-B Quality

# BAKER COMPRESSORS

*equipped with*

## ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Why are Allen-Bradley starters so popular for refrigeration and air-conditioning service? . . . Because they do not require regular attention; they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley cadmium silver alloy contacts never need cleaning, filing, or dressing.

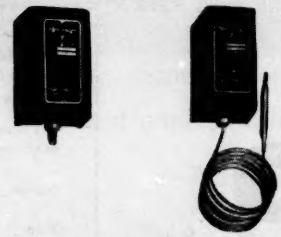
Dependable overload relays . . . Allen-Bradley thermal relays are dependable and remain accurate in their operation, even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co., 1330 S. Second St., Milwaukee 4, Wis.

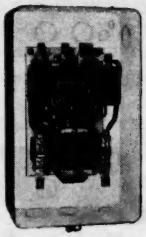
### Typical Refrigeration Controls

**PRESSURE AND TEMPERATURE CONTROLS**



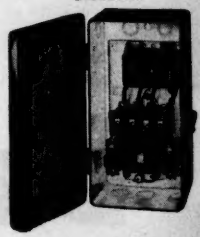
A-B Bulletin 836 pressure control and A-B Bulletin 837 temperature control. Accurate, rugged, compact units.

**AUTOMATIC STARTER**



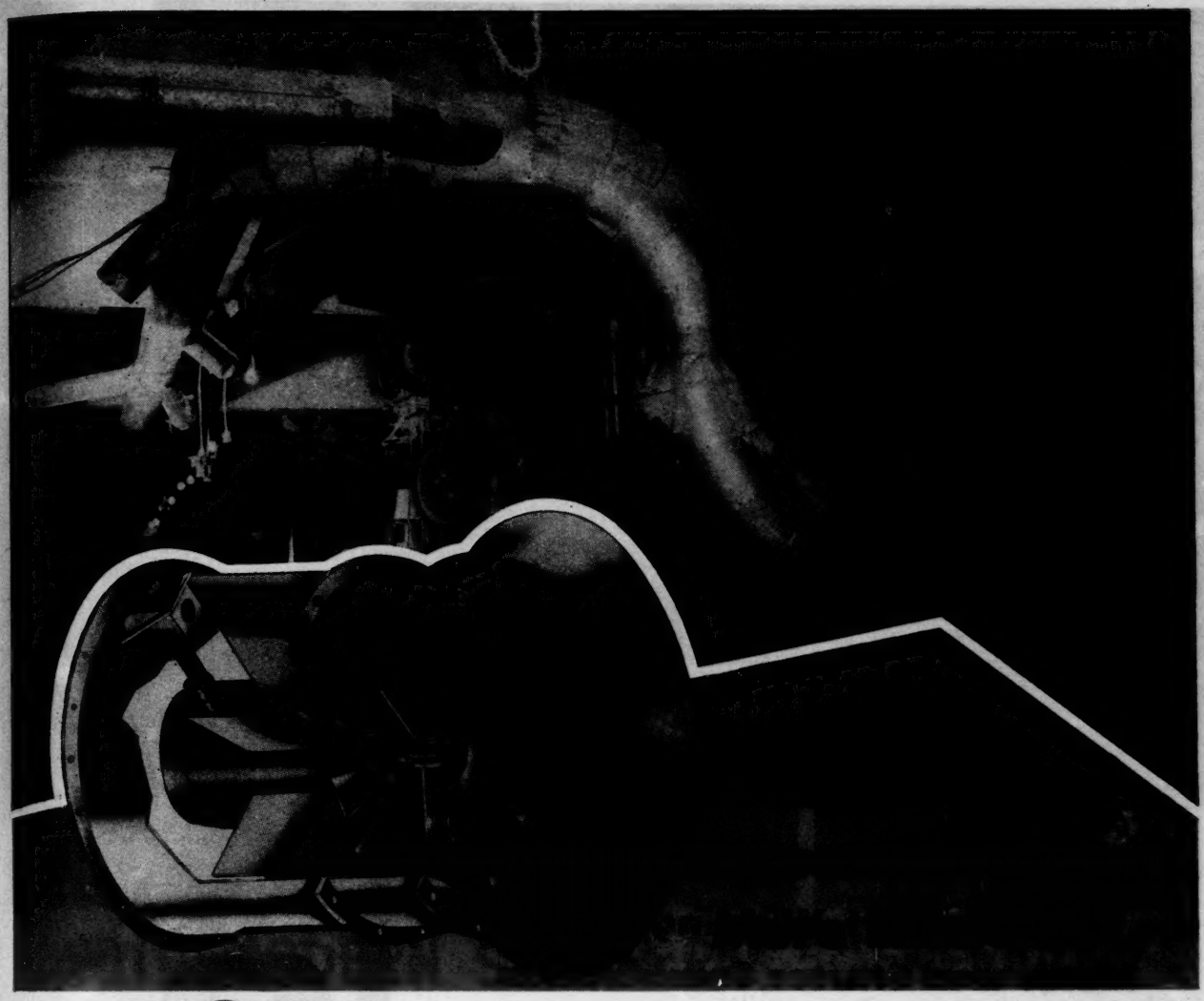
A-B Bulletin 709 solenoid starter. Note white interior for ease of wiring.

**COMBINATION STARTER**



A-B Bulletin 712 disconnect switch type combination starter. Saves installation time.

## ALLEN-BRADLEY SOLENOID MOTOR CONTROLS



# JOY AXIVANE* FANS

## (SERIES 1000)

Write for Bulletin, or

*Consult a Joy Engineer*

The quieter operation, lighter, more compact design, lower power consumption and unmatched efficiency of JOY Axivane Fans are *real* advantages! What's more, their vaneaxial design and in-line construction permit mounting right in the air duct, making installation simple and saving greatly on time and cost. These features, plus the extreme flexibility of operating range made possible by adjustable blades—a standard feature of all JOY Fans—mean better, more dependable and lower-cost ventilation, no matter what your conditions are.

● Let JOY Axivane Fan specialists work with you for best results on your ventilation jobs.

*Reg. U. S. Pat. Off.

W&D 12-55

## JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LTD.

*Investigate the many advantages of using*

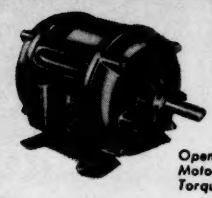
## the Wagner Part-Winding Increment Motor and Starter Combination

The Wagner part-winding increment motor and starter combination provides an economical method of starting polyphase squirrel-cage motors when reduced current draw at start is required. No auto-transformers or resistors are necessary.

Wagner polyphase motors for part-winding starting, both normal and high torque, are wound with two circuits in parallel. The magnetic type increment starter has two magnetic contactors. When the first contactor closes, the line is connected to one group of the motor windings and a pneumatic timer is started. After the desired time interval, the pneumatic timer closes the second magnetic contactor which connects the line to the other part of the motor winding. Using this motor and starter combination, the current drawn from the line is about 60 percent of the normal locked current of the motor. It has the advantage that the current taken from the line is not broken during the starting period, as is the case when auto-transformers or compensator-type starters are used.

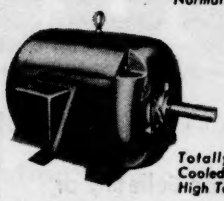
Motors with manual type starters are also available.

*This magnetic part-winding increment starter can be furnished in combination with any of these Wagner Motors.*

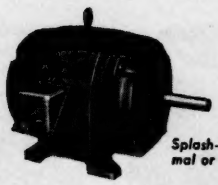


*Open General Purpose Motor. Normal or High Torque.*

*Explosion-Proof Motor. Normal or High Torque.*



*Totally-Enclosed Fan-Cooled Motor. Normal or High Torque.*



*Splash-Proof Motor. Normal or High Torque.*

**WAGNER ELECTRIC CORPORATION**
**6463 Plymouth Ave., St. Louis 14, Mo., U.S.A.**

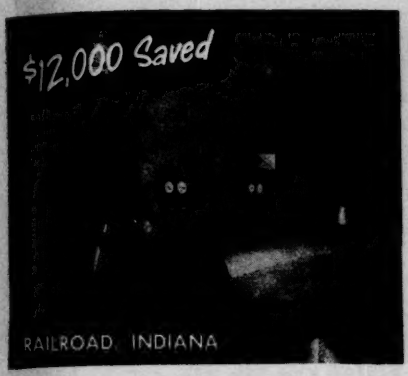
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

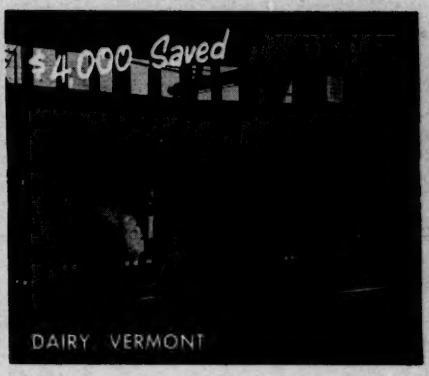
**BRANCHES IN 32 PRINCIPAL CITIES**

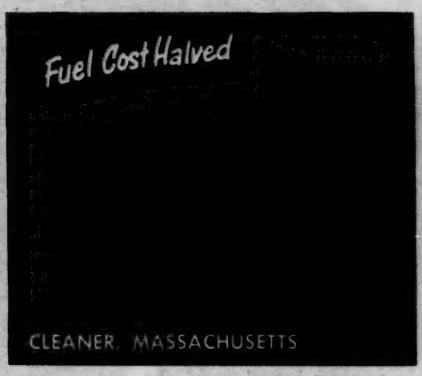
Wagner Electric Corporation
EST. 1891

M29-4

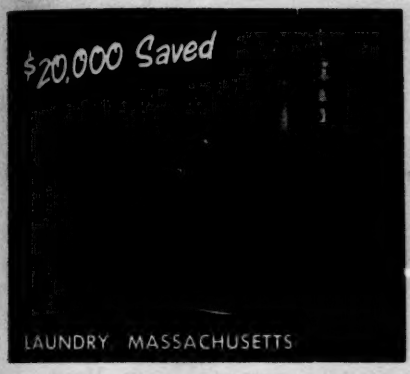
# YOU TOO, CAN SAVE THOUSANDS OF

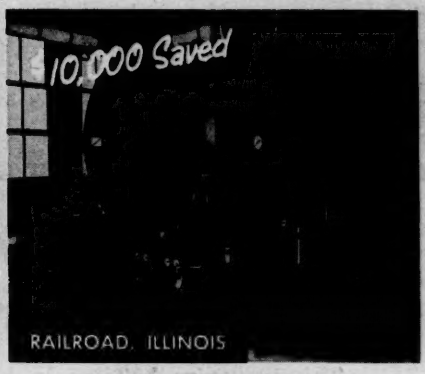


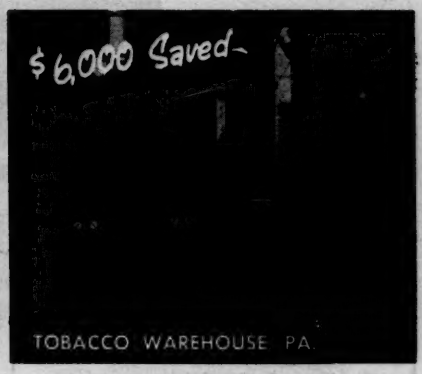



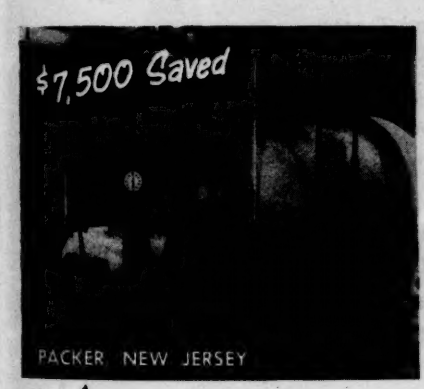

# DOLLARS ANNUALLY ON STEAM COSTS

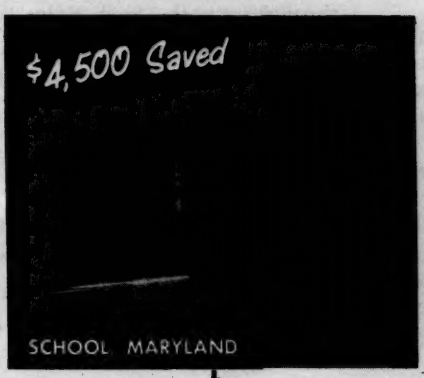


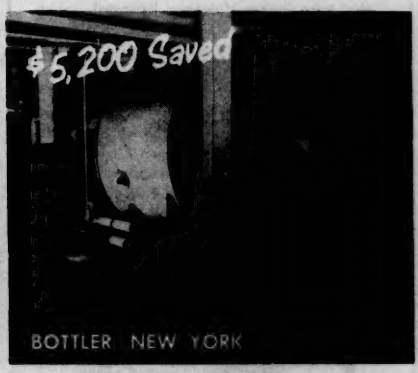




# WITH MODERN STEAM-PAK *GENERATORS




* Steam-Pak Generators are self-contained high or low pressure steam or hot water heaters ranging from 15 to 250 hp. in capacity. Steam-Paks are fired with oil (No. 3, 5 or 6), gas, or a combination of gas and oil. They are easily installed, fully automatic, and efficient.

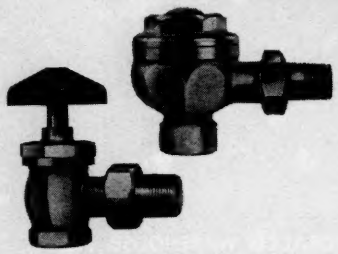
**GET THIS BOOK TODAY!**

Steam-Pak's 208-page Architects' Manual is the only complete reference on steam generators. Contains specifications, hook-ups, wiring and piping diagrams, operating charts. Request Manual 101-C today on your letterhead.

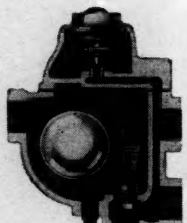
Steam-Pak Generators — A Product of York-Shipley, Inc., York, Pa.

Mar

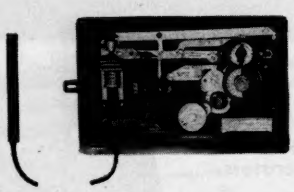
John Moses Veterans Hospital, Minot, North Dakota.
Corps of Engineers were the engineers; Carlson Duluth Company, Mechanical contractors.



The Marsh Radiator Valve is packless, not just in name but in service . . . year after year. Best team-mate for it is the time-proved, trouble-free Marsh Trap. This combination was used throughout the John Moses Veterans Hospital.



You can depend on the wide line of Marsh float and thermostatic traps. Thousands are proving this in daily service.



The simple, low-cost, easy-to-install regulator for all multiple-occupancy buildings. By keeping inside heat in step with outside weather it assures ideal comfort at minimum fuel cost.

## Marsh Valves and Traps Chosen for another Big Heating System

This impressive building is the recently completed John Moses Veterans Hospital at Minot, North Dakota. It is another significant addition to the long list of big, well-constructed buildings equipped throughout with Marsh Valves and Traps.

The selection of valves and traps for buildings of this size calls for utmost caution. That is why we keep pointing out the ever-recurring selection of Marsh equipment for larger buildings. It is your best proof that Marsh is at the top of the list for the most exacting jobs in every part of the country.

And what job isn't exacting? For your next one use the radiator valve with the metal-to-metal seal — the valve that is truly packless. Team it up with that masterpiece of precision — the Marsh Radiator Trap. You will then know how dependable and trouble-free a valve and trap can be.

***Ask for Catalog 76-H covering the full line of Marsh Heating Specialties***

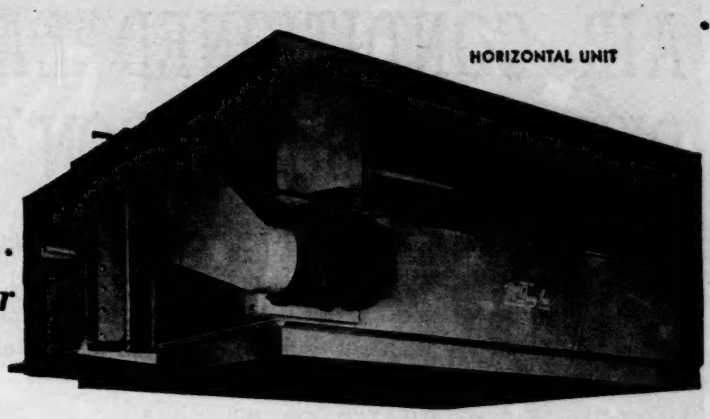
**MARSH HEATING EQUIPMENT CO.**
*Sales Affiliate of Jas. P. Marsh Corporation*
**Dept. U., Skokie, Ill.**

# MARSH

*Quality Heating Specialties* **SINCE 1865**

**IN 8 MODELS**

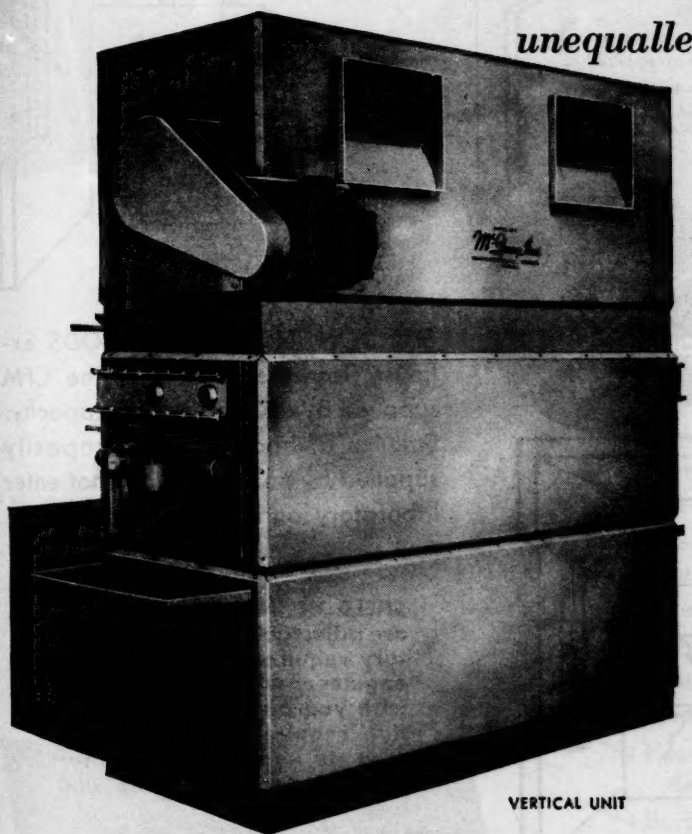
*up to 65 tons cooling capacity...15,675 Cfm... 2,200,000 Btu per hour heating capacity*



HORIZONTAL UNIT

# McQuay CENTRAL STATION AIR CONDITIONERS

*...with* **RIPPLE-FIN** *construction to give you unequalled heat transfer efficiency!*



VERTICAL UNIT

Both the horizontal and vertical Central Station Air Conditioners provide year 'round comfort with cooling and dehumidification, heating and humidification, positive ventilation, and air filtering.

Each of eight models are sectionally built to give complete flexibility of arrangement and all parts are readily accessible to allow for ease of installation and service.

The famous McQuay Ripple-Fin Coils assure unmatched heat transfer efficiency. Also, because of the wide range of Cfm and Btu capacities offered, every normal heating and cooling application can be accurately met with McQuay Central Station Air Conditioners.

Auxiliary features available include: direct expansion, water, and steam coils, mixing box with dampers, "V" type and flat filter sections, humidifiers, and internal face and by-pass damper sections.

**Representatives in principal cities. Write for Bulletin 502. McQuay, Inc., 1619 Broadway St. N. E., Minneapolis 13, Minnesota.**

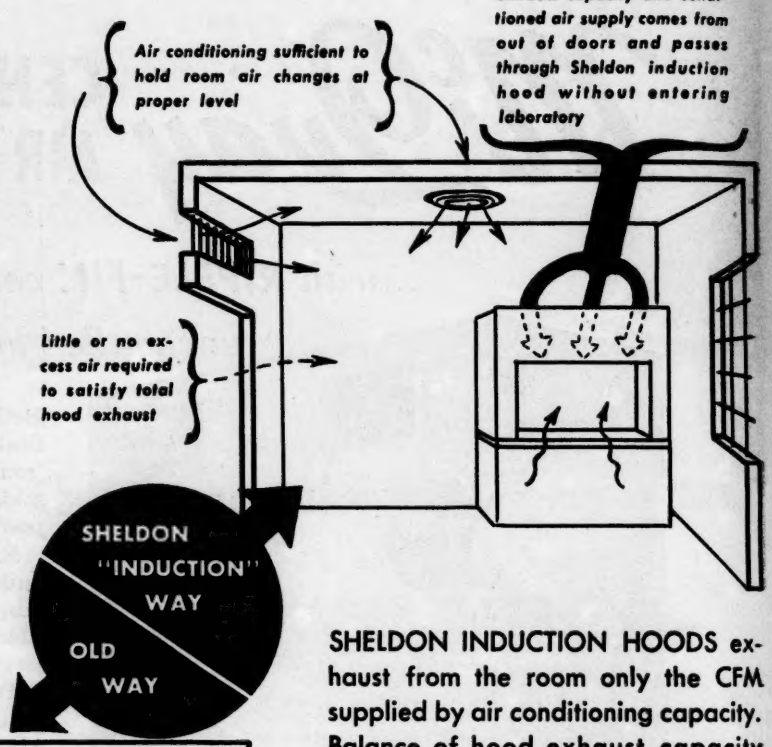
# McQuay INC.

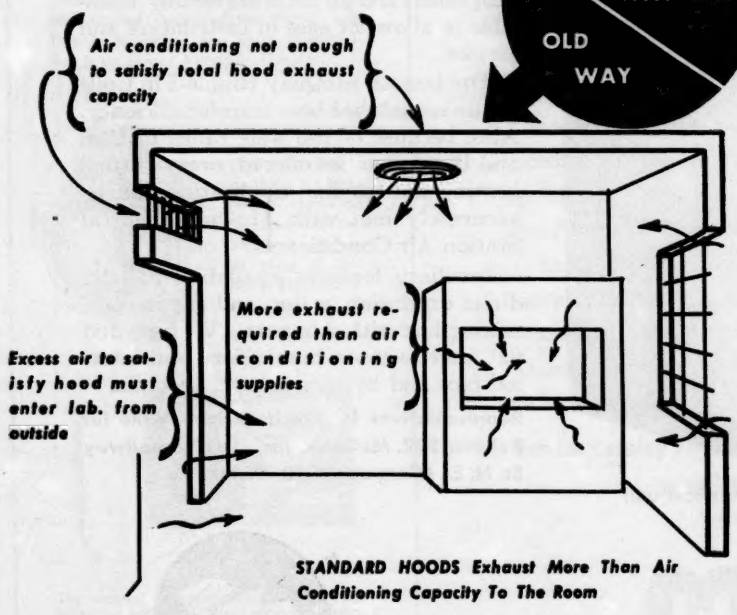
**HEATING • REFRIGERATION • AIR CONDITIONING**

# AIR CONDITIONED LABORATORY FUME DISPOSAL with SHELDON "INDUCTION" HOODS

**SHELDON HOODS FOR CONSERVING ROOM AIR** are designed to exhaust definite VOLUMES of air from the laboratory and hold the air changes within the room at predetermined levels. At the same time ample volumes of air pass thru the working area of the hoods to efficiently handle generated fumes.

**SHELDON SELF VENTILATED OR INDUCTION HOODS** operate efficiently under a ratio as low as ONE FOURTH of the volume of *room air* that standard hoods require. The balance of required air volume comes from the outside atmosphere and needs no conditioning. This reduces the conditioning load for both cooling and heating and makes practical air conditioned laboratories with large capacity fume hood installations at economical levels. For example: 12 linear feet of hood capacity will operate efficiently at as low as 600 CFM of air from the room whereas ordinary hoods using comparable volumes of air should draw 2400 CFM of room air.


Difference between hood exhaust capacity and conditioned air supply comes from out of doors and passes through Sheldon induction hood without entering laboratory
Air conditioning sufficient to hold room air changes at proper level
Little or no excess air required to satisfy total hood exhaust
SHELDON "INDUCTION" WAY
OLD WAY


Air conditioning not enough to satisfy total hood exhaust capacity
More exhaust required than air conditioning supplies
Excess air to satisfy hood must enter lab. from outside

*STANDARD HOODS Exhaust More Than Air Conditioning Capacity To The Room*

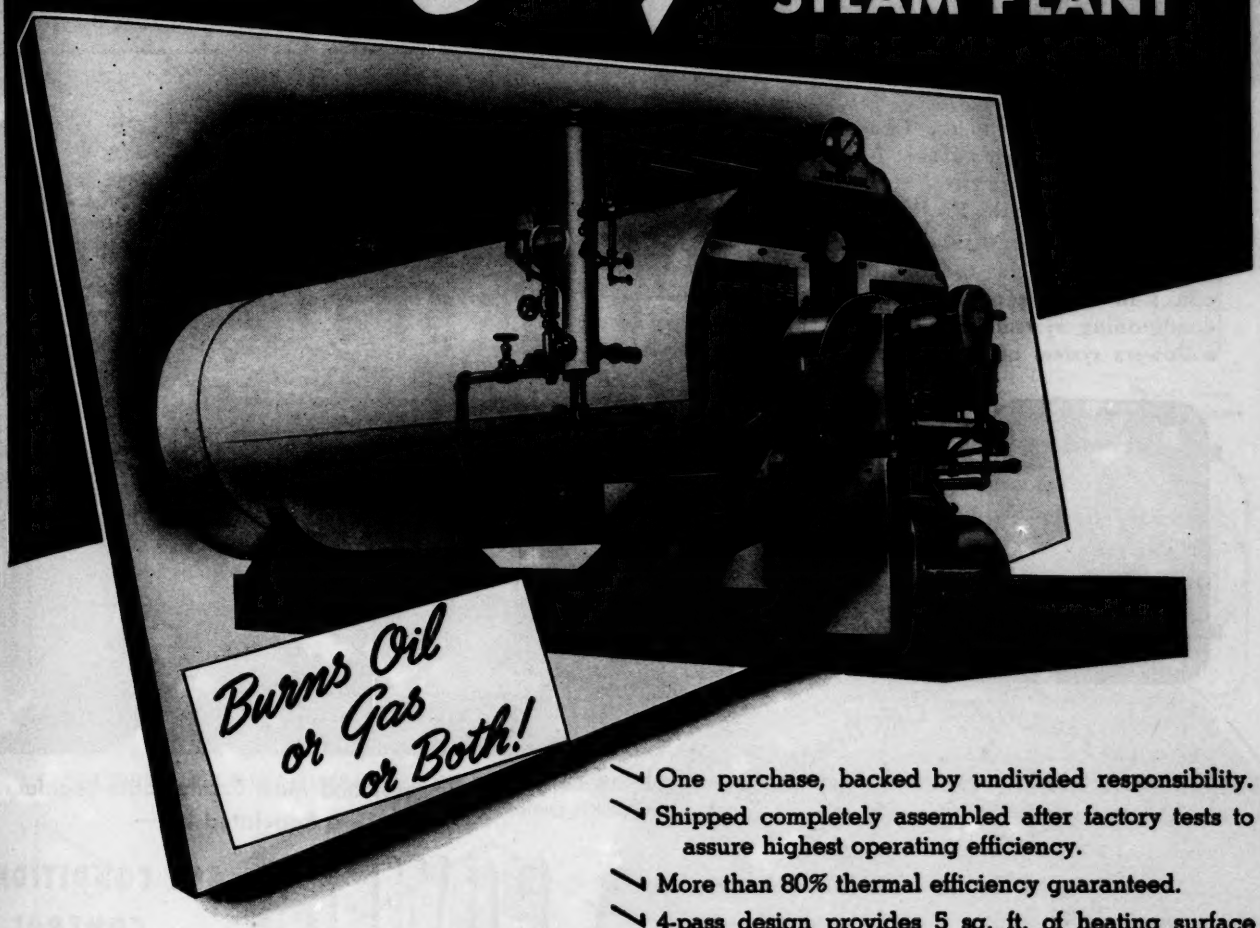
**SHELDON INDUCTION HOODS** exhaust from the room only the CFM supplied by air conditioning capacity. Balance of hood exhaust capacity supplied by hood and does *not* enter laboratory and is *not* conditioned.

**SHELDON INDUCTION HOODS are adjustable to meet laboratory requirements. Our sales engineers will be glad to work with you on definite installation requirements. Write or wire Muskegon, Michigan, for the nearest sales office and engineer.**

## E. H. SHELDON EQUIPMENT COMPANY

MUSKEGON, MICHIGAN

HERE'S YOUR *Complete* STEAM PLANT




- One purchase, backed by undivided responsibility.
- Shipped completely assembled after factory tests to assure highest operating efficiency.
- More than 80% thermal efficiency guaranteed.
- 4-pass design provides 5 sq. ft. of heating surface per b.h.p.
- Induced draft fans which are built-in eliminate the need of an expensive chimney.
- Simple installation requires no special foundation.
- Clean, quiet operation.
- Heavy-duty, rugged construction assures long-lived dependability.
- Burner equipment to suit your fuel: gas, oil or both.
- 18 sizes from 20 to 600 b.h.p. for pressures up to 250 p.s.i., or for hot water heating.
- For complete details, write today for catalog 419.

SUPERIOR STEAM GENERATORS

**SUPERIOR COMBUSTION INDUSTRIES, Inc.**

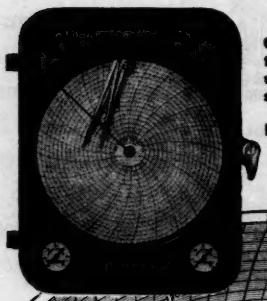
*Factory: Emmaus, Pa.*

*Executive Offices: Times Building, Times Square, New York 18, N. Y.*

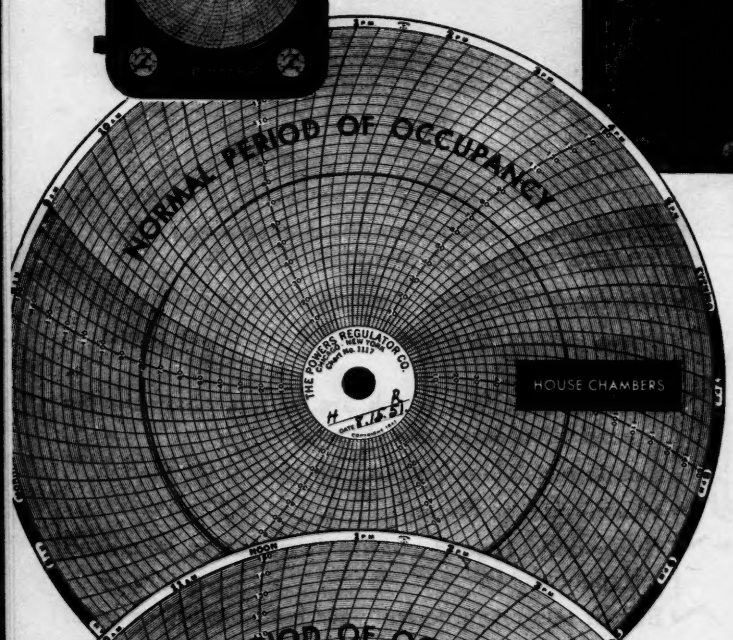
# POWERS

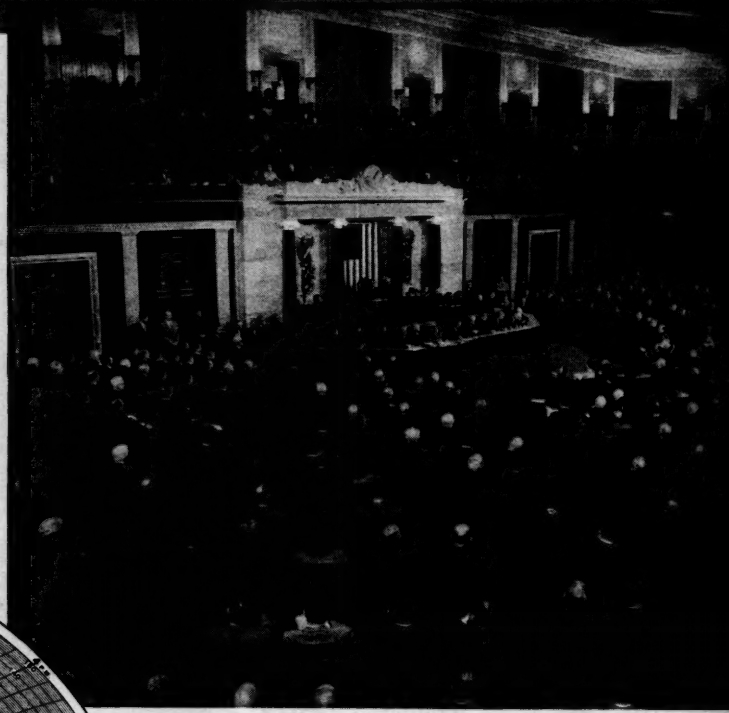
*Right:* Joint session of the Congress in the recently remodeled House of Representatives—listening to "State of the Union" address by the President.

In the historic House and Senate Chambers as well as the administrative offices in the Capitol, heating and air conditioning systems are regulated by a Powers system of pneumatic control.



Only a few of the many types of Powers Control used in the Capitol are shown here.
Left: Powers Two-pen Recording Controller.





World's Largest and Most Comfortable Legislative Hall is Regulated by—

**POWERS** AIR CONDITIONING CONTROL

◀ Note Accurate Control in House and Senate Chambers

Outdoor temperatures, during the period covered by the temperature charts varied between 75 and 95° F., yet indoor temperature was maintained constant from 9 A.M. to 5 P.M. One temperature sensitive bulb is located near the speaker's rostrum, another is in the gallery. Note separate lines during the off period of control and how the two lines merge into one when Chambers were occupied.

## THE POWERS REGULATOR CO.

3400 OAKTON ST., SKOKIE, ILLINOIS • Offices in Over 50 Cities

Chicago 13, Ill., 3819 N. Ashland Ave. • New York 17, N. Y., 231 E. 46th St.
Los Angeles 5, Cal., 1808 West 8th Street • Toronto, Ontario, 195 Spadina Ave.
Mexico, D. F., Apartado 63 Bis. • Honolulu 3, H. I., P. O. 2755—450 Piikoi at Kin

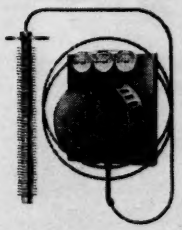
*Over 60 Years of Automatic Temperature and Humidity Control*

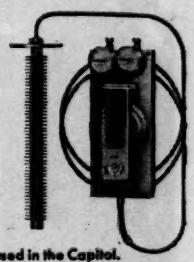
## Other Washington Buildings using POWERS Control

Department of Agriculture and Post Office Department Bldgs., Department of Interior and Old House of Representatives Office Bldgs., Social Security R. R. Retirement Bldg., Apex Bldg., Lafayette Bldg., U. S. Navy Hydrographic Bldg., Washington National Airport.

Experience gained by Powers in supplying dependable temperature and humidity regulation for these buildings may be helpful to you. When your problems involve precise control for heating or air conditioning, contact Powers nearest office . . . in over 50 cities.

Powers Room Type Thermostat

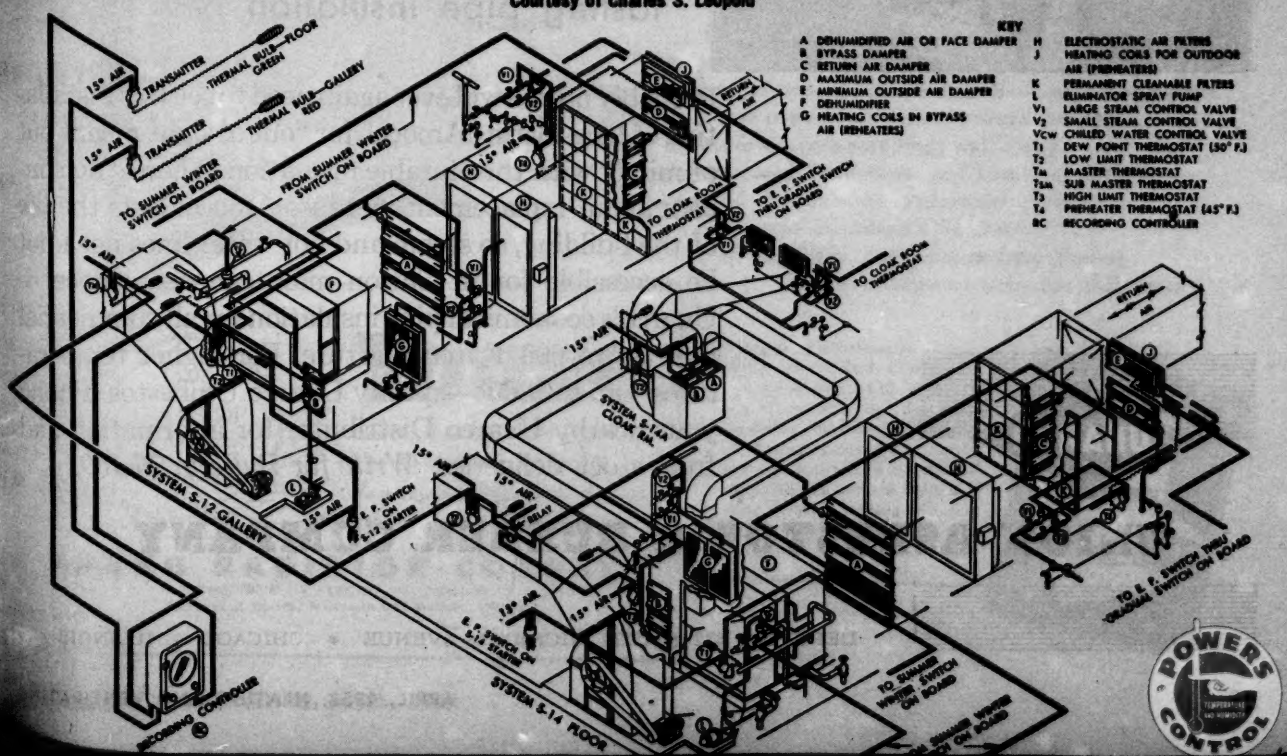


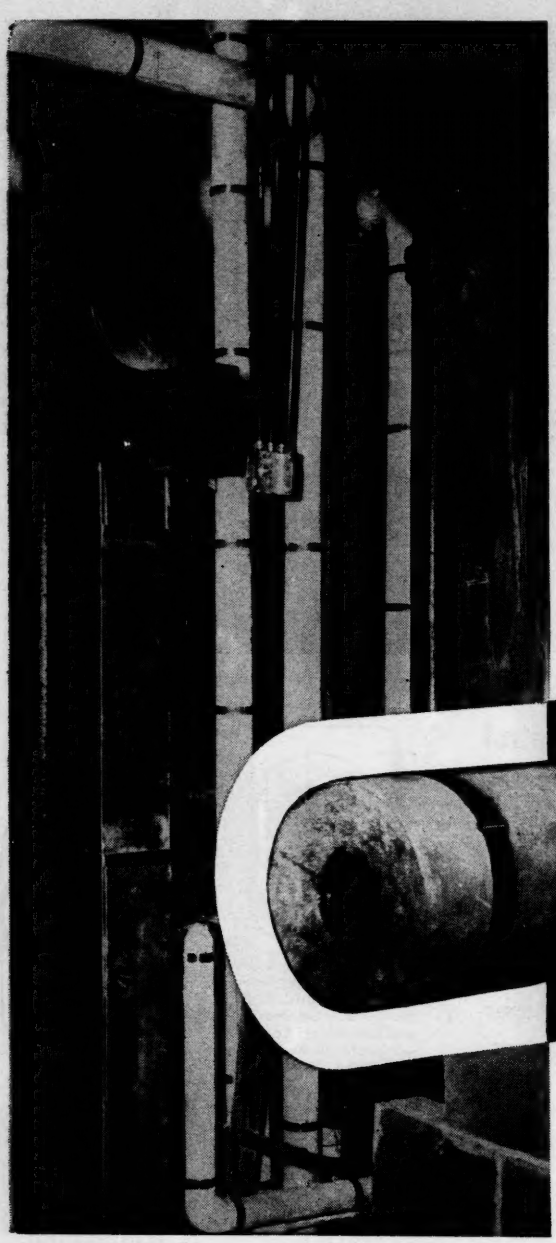


Powers Remote Bulb Thermostats for Dew Point, Low and High Limit, Preheater, Master and Sub-Master Control —only a few of the many controls used in the Capitol.

### AIR CONDITIONING APPARATUS DIAGRAM FOR OPERATION AND MAINTENANCE OF SYSTEMS IN THE HOUSE AND SENATE CHAMBERS

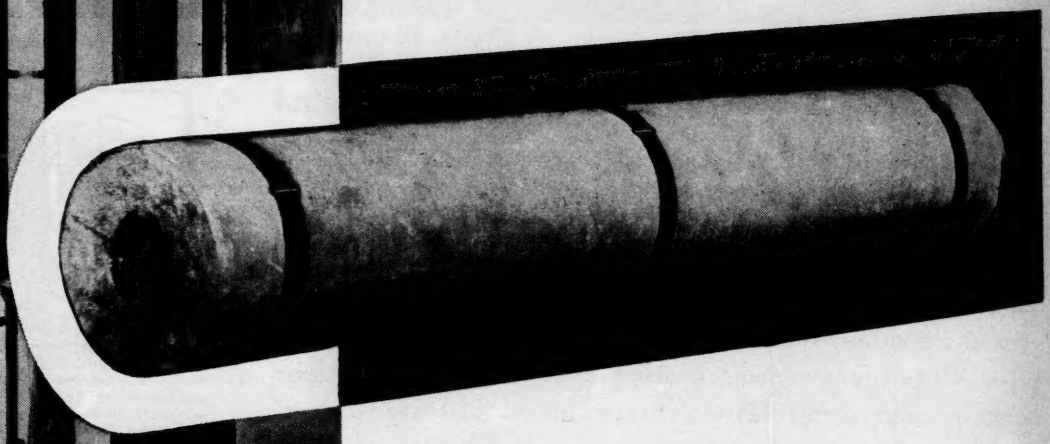
Courtesy of Charles S. Leopold


KEY
A DEHUMIDIFIED AIR OR FACE DAMPER
B BYPASS DAMPER
C RETURN AIR DAMPER
D MAXIMUM OUTSIDE AIR DAMPER
E MINIMUM OUTSIDE AIR DAMPER
F DEHUMIDIFIER
G HEATING COILS IN BYPASS AIR (REHEATERS)
H ELECTROSTATIC AIR FILTERS
J HEATING COILS FOR OUTDOOR AIR (PREHEATERS)
K PERMANENT CLEANABLE FILTERS
L ELIMINATOR SPRAY PUMP
V1 LARGE STEAM CONTROL VALVE
V2 SMALL STEAM CONTROL VALVE
VCW CHILLED WATER CONTROL VALVE
T1 DEW POINT THERMOSTAT (50° F.)
T2 LOW LIMIT THERMOSTAT
TM MASTER THERMOSTAT
TSM SUB MASTER THERMOSTAT
T3 HIGH LIMIT THERMOSTAT
T4 PREHEATER THERMOSTAT (45° F.)
RC RECORDING CONTROLLER
15° AIR
TRANSMITTER
THERMAL BULB—FLOOR GREEN
THERMAL BULB—GALLERY RED
TO SUMMER WINTER SWITCH ON BOARD
FROM SUMMER WINTER SWITCH ON BOARD
RETURN AIR
TO CLOAK ROOM THERMOSTAT
TO E. P. SWITCH THRU GRADUAL SWITCH ON BOARD
SYSTEM S-14A CLOAK RM.
SYSTEM S-12 GALLERY
E. P. SWITCH ON S-12 STARTER
RELAY
SYSTEM S-14 FLOOR
RECORDING CONTROLLER
POWERS CONTROL



# YOU SAVE FROM THE VERY BEGINNING WITH

# Amocel



...the easy-to-use, long lasting pipe insulation

Probably no one will ever again need to see this installation of long-lasting Amocel, for "out of sight means out of mind" with this durable insulation. There's no concern about replacement, because Amocel lasts the life of the building, so steam and hot water lines need not be accessible for insulation maintenance. Amocel is Unarco's economical pipe insulation for all commercial uses up to 600°F. temperature. For higher temperatures—up to 1200°—specify Unarco Unibestos. Phone your nearby Unarco Distributor for information and from-stock deliveries. *Write for Bulletin 76-109.*

UNARCO

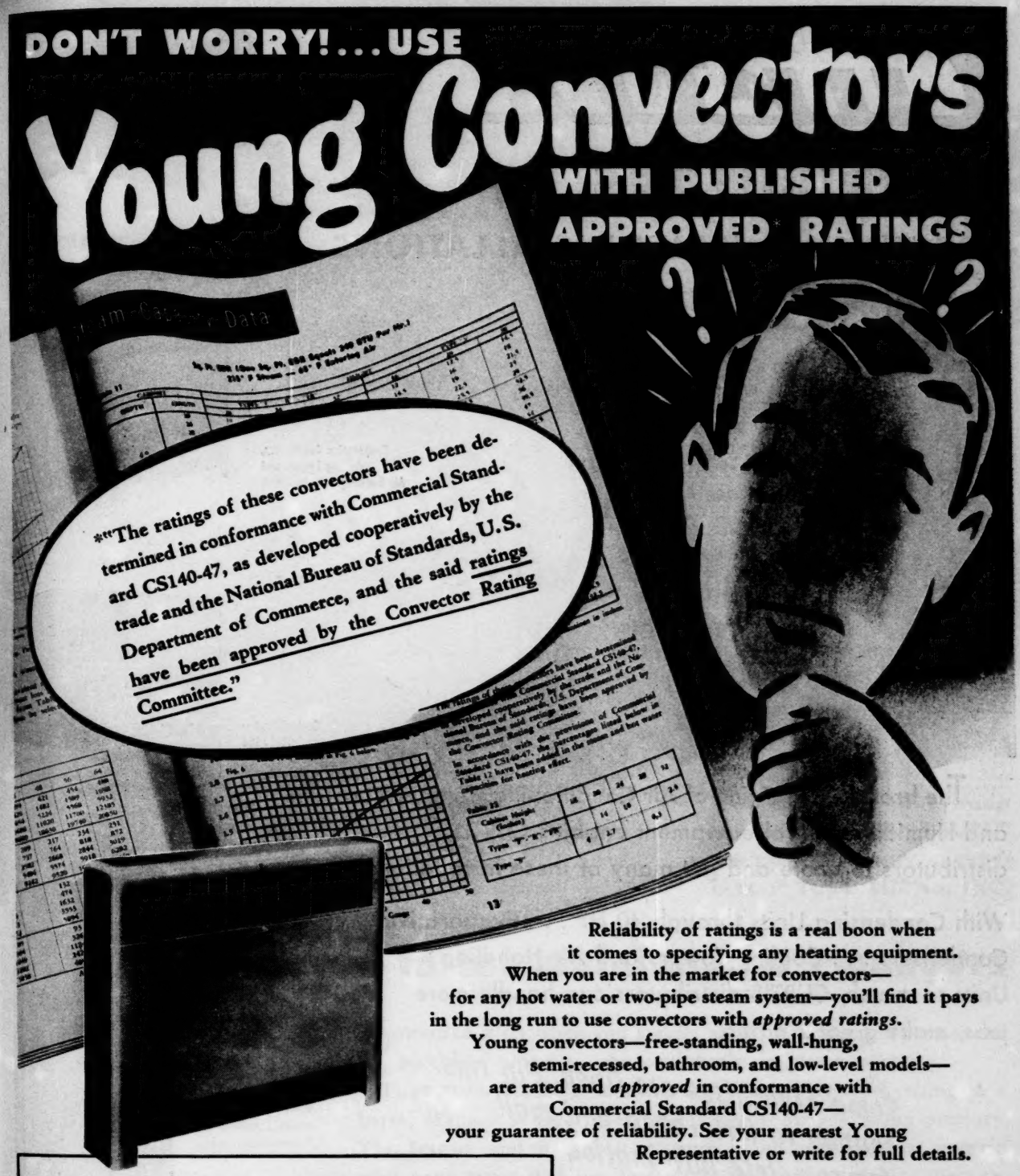
**UNION ASBESTOS & RUBBER COMPANY**

DEPT. B-4, 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

DON'T WORRY!...USE

# Young Convectors

## WITH PUBLISHED APPROVED RATINGS


*"The ratings of these convectors have been determined in conformance with Commercial Standard CS140-47, as developed cooperatively by the trade and the National Bureau of Standards, U.S. Department of Commerce, and the said ratings have been approved by the Convector Rating Committee."

Reliability of ratings is a real boon when it comes to specifying any heating equipment. When you are in the market for convectors—for any hot water or two-pipe steam system—you'll find it pays in the long run to use convectors with *approved ratings*. Young convectors—free-standing, wall-hung, semi-recessed, bathroom, and low-level models—are rated and *approved* in conformance with Commercial Standard CS140-47—your guarantee of reliability. See your nearest Young Representative or write for full details.

1927 • 1952
25 YEARS OF PROGRESS IN HEAT TRANSFER ENGINEERING

**YOUNG**

Heating, Cooling, Air Conditioning Products for Home and Industry.

Heat Transfer Products for Automotive and Industrial Applications.

**YOUNG RADIATOR COMPANY**

Dept. 522-D • RACINE, WISCONSIN
Factories at Racine, Wisconsin and Mattoon, Illinois

If you think all convectors are alike, you'll find Catalogs No. 4049 and 4150 revealing. They give full details, including illustrated features of Young Convectors, approved ratings, dimension data, etc. Be sure to have a copy in your catalog file. It will be sent you without obligation.

# Curtis

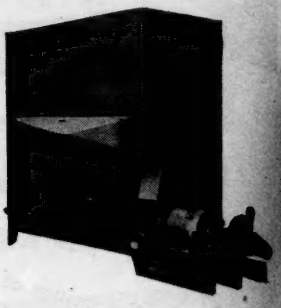
## DISTRIBUTORS

## ARE MAKING MANY INSTALLATIONS IMPORTANT TO DEFENSE

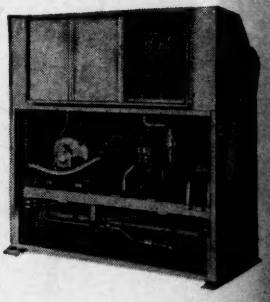
Water-cooled Condensing Units —through 40 tons

*in*

- Army, Navy, Air Force Projects,
- Industrial Processing,
- Research Laboratories,
- Commissaries,
- Storage Plants— Food, Biological, Chemical



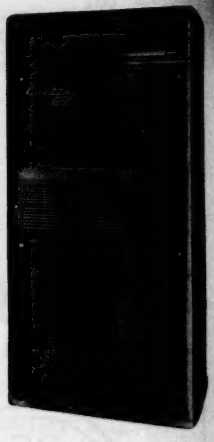
Evaporative Condensers, Cooling Towers and Air Handling Units to match



Central Type— 10-15 ton

The broad CURTIS line of Air Conditioning, Temperature and Humidity Control equipment enables CURTIS distributors to *quote* and *get* many of these installations.

With Condensing Units through 40 HP . . . Evaporative Condensers . . . Cooling Towers and Air Handling Units to match, CURTIS distributors can handle *more jobs, make greater profits.*



Package Type— 2-4-6-8 ton

*Some Franchises are Open. Pin this coupon to letterhead and mail for complete information*

Curtis REFRIGERATION AIR CONDITIONING COMMERCIAL

Curtis Refrigerating Machine Division
*of Curtis Manufacturing Company*
1999 Kienlen Avenue • St. Louis 20, Missouri

I am interested in a Direct Curtis Factory Franchise. Send complete details.

Name_____

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City_____ Zone____ State_____

R51-8

*98 Years of Successful Manufacturing Experience is "Built-In" Curtis Equipment*

*Remember*—the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS, INC.

# Engineered to cut maintenance manhours

*Scrappy says, "Aid defense—more scrap today...more steel tomorrow."*

Write Dept. B-4 for free booklet on Allowable Working Pressures. Use coupon on reverse side.

CONSIDER THIS when you specify welding fittings for permanent, leakproof piping . . . the kind that's maintenance-free:

TUBE-TURN Welding Tees are drawn from seamless tubing to a barrel shape—the form every tee wants to assume under pressure. This feature, and the generous crotch radius and thickness, explain why TUBE-TURN Welding Tees withstand more pressure than required. Bursting pressures obtained in tests of representative fittings have averaged over 25% higher than required by standard codes.

For this extra quality at no extra cost get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

*Be sure you see the double "tt"*

**TUBE TURNS, INC.** LOUISVILLE 1, KENTUCKY

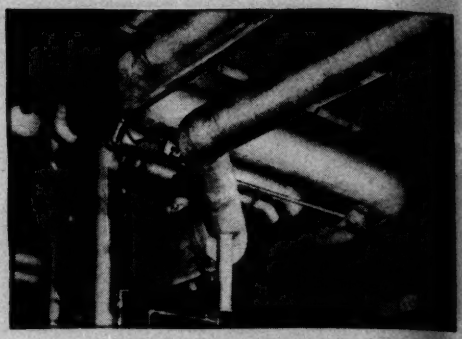
DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles
TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO... A wholly owned subsidiary of TUBE TURNS, INC.

# Servel, Inc. specifies piping permanence with TUBE-TURN Welding Fittings

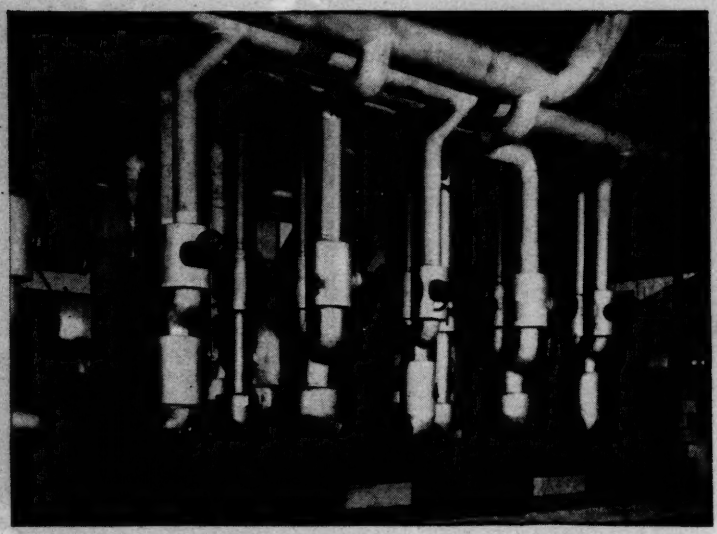
THE EXTENSIVE piping systems which serve the modern 70-acre Servel plant, in Evansville, Indiana, carry steam, condensate, air, water, acetylene, ammonia, hydrogen, oxygen, and natural gas—*efficiently*.

To avoid leakage and downtime for piping repairs, Servel engineers specify the use of TUBE-TURN Welding Fittings and Flanges for all lines 2 inches and up. Thus maintenance expense is cut to the bone. The welded system also conserves space, and provides optimum flow conditions.

Such efficiency in production services has played a large part in the growth of Servel, Inc., makers of the famous Servel gas and electric refrigerators and a variety of other products.



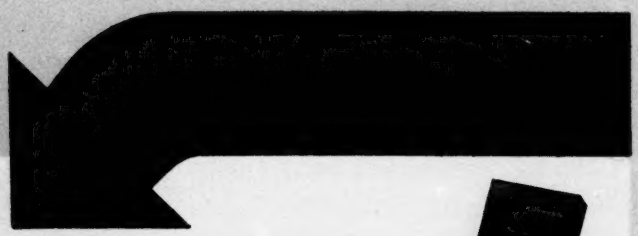
With no flanges to work around, insulation was easily applied to welded steam lines. Joints will not leak, and insulation will last.



These 2½", 3", 6", and 8" lines for return water pumps and water booster pumps are fabricated with TUBE-TURN Welding Fittings. Close-fitting welded piping is compact and neat.

Steel blanks for cartridge cases are washed in this tank prior to forging operation. Time was saved in tank construction by fabricating heating coils with 1½" TUBE-TURN Welding Returns. Dimensional accuracy assured perfect line-up.

Careful quality control is demonstrated by this spectrographic analysis, made of every TUBE-TURN alloy Welding Fitting before pickling, passivating, and shipping. This check, one of many, assures that user's specifications are met.



**TUBE TURNS, INC., Dept. B-4**
224 East Broadway, Louisville 1, Kentucky

*Your Name* .....

*Position* .....

*Company* .....

*Nature of Business* .....

*Address* .....

*City* ..... *State* .....

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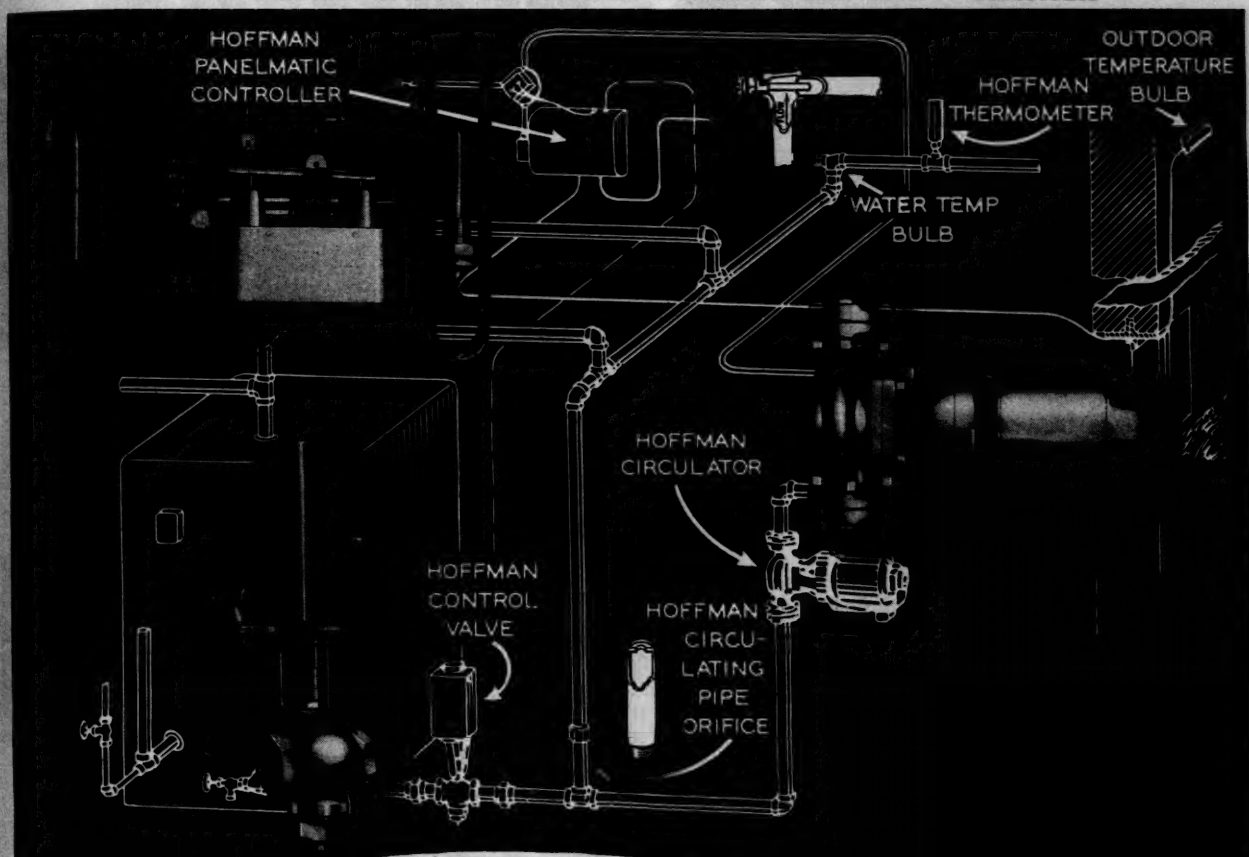
"tt" and "TUBE-TURN" Reg. U. S. Pat. Off.

# TUBE TURNS, INC.

LOUISVILLE 1, KENTUCKY

# HOFFMAN PANELMATIC *Hot Water System Controls*

**AUTOMATICALLY BALANCES WATER TEMPERATURE WITH WEATHER**




CONTINUOUSLY CIRCULATED HOT WATER SYSTEM

## Designed especially for AUTOMATIC HOT WATER

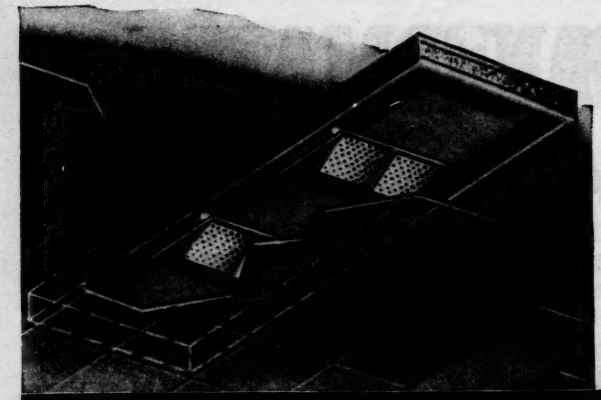
The Hoffman Panelmatic Controller is based on the fact that for every Outdoor Temperature there is a corresponding Supply-water Temperature, which must be *automatically maintained* in the heating units. The correct Supply-water Temperature, in the case of a panel heating system, or the output per sq. ft. EDR in the case of other forms of radiation, must be specified by the Architect or Engineer for *one Outdoor Temperature*. The Controller then *automatically* adjusts the Water Temperatures to balance any other outdoor conditions encountered. The following table illustrates several sets of conditions for a panel heating system.

| Architect or Engineer to Specify | | | Factory Sets Controller | | Controller Automatically Furnishes Supply Water at Temperatures Correct for Any Outdoor Temp. as Listed Below | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Outdoor Temperature °F. | | | | |
| Design Temp. °F. | Supply Water °F. | Room Temp. °F. | Scale No. | Supply Water °F. at Outdoor 32 °F. | −10 | 0 | +10 | +30 | +50 |
| | | | | | SUPPLY WATER TEMPERATURE °F. | | | | |
| −10 | 150 | 70 | 11 | 108 | 150 | 140 | 130 | 110 | 90 |
| 0 | 150 | 70 | 13½ | 114 | — | 150 | 139 | 116 | 94 |
| +10 | 140 | 70 | 14 | 115 | — | — | 140 | 117 | 94 |
| −10 | 140 | 70 | 9 | 104 | 140 | 132 | 123 | 106 | 88 |
| −10 | 160 | 70 | 13 | 113 | 160 | 147 | 137 | 115 | 92 |

When the outdoor temperature reaches 65°F., the Circulator automatically stops. The 65° factory setting was chosen because it is the basis for calculating degree days. If a different cut-out temperature is desired, it can be easily adjusted to individual requirements. Occasionally the actual heat loss differs from the calculated loss due perhaps to changes in construction. The Panelmatic Controller can be easily re-adjusted after installation according to simple, definite instructions furnished by the factory. Technical literature describing the Panelmatic System and sample specifications, gladly furnished on request.

PIONEERED BY HOFFMAN

HOFFMAN SPECIALTY COMPANY, Dept. B-4, 1001 York St., Indianapolis 7, Ind.



# MULTI-VENT

T.M. REG. U. S. PAT. Off.

***Low Velocity Air Diffusion***

# in hospitals

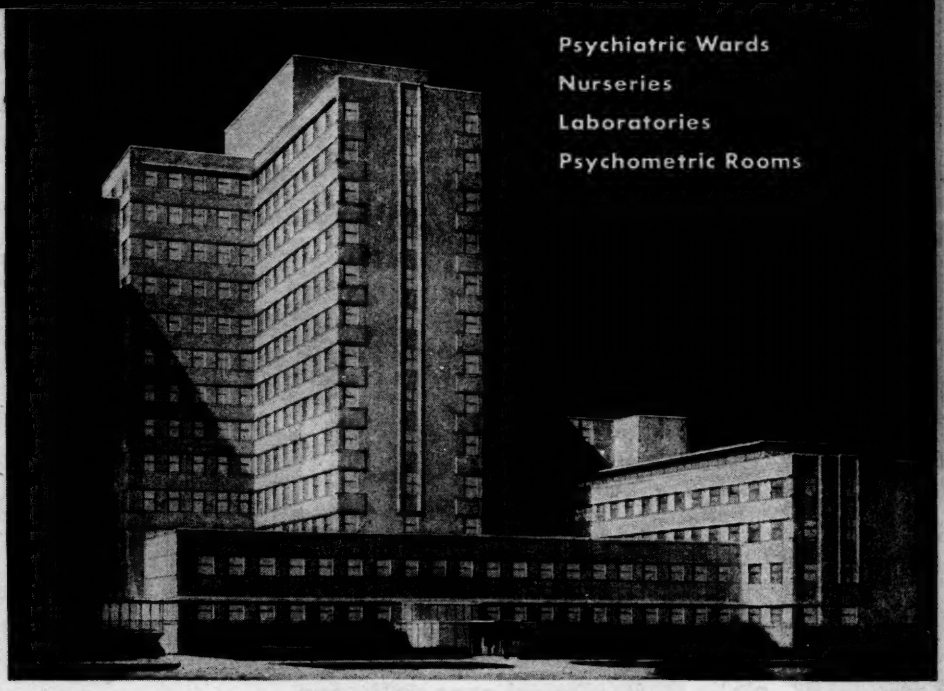
**Operating Rooms**
**Environment Control Rooms**
**Delivery Rooms**

## where precise atmosphere control is vital!

### Recent hospital Multi-Vent installations

MAYO BROTHERS CLINIC, Rochester, Minnesota
CHICAGO LYING-IN HOSPITAL, Chicago, Illinois
YAKIMA VALLEY MEMORIAL HOSPITAL, Yakima, Wash.
FRESNO COUNTY HOSPITAL, Fresno, California
NEW L.D.S. PRIMARY CHILDREN'S HOSPITAL, Salt Lake City, Utah
CHICAGO STATE T. B. SANATORIUM, Chicago, Illinois
ST. JOSEPH MEMORIAL HOSPITAL, St. Joseph, Mich.
T. B. HOSPITAL, Ohio State University Medical Center
ST. VINCENT'S HOSPITAL, Santa Fe, New Mexico
SAMARITAN HOSPITAL, Ashland, Ohio
NATIONAL INSTITUTE OF HEALTH, Bethesda, Maryland
ROSE MEMORIAL HOSPITAL, Denver, Colorado
ELIZABETH STEEL MAGEE HOSPITAL, Pittsburgh, Penn.
A.E.L. BUILDING #599, U. S. Naval Base Philadelphia, Pa.
BEAR LAKE MEMORIAL HOSPITAL, Montpelier, Idaho
L.D.S. HOSPITAL X-RAY DIVISION, Salt Lake City, Utah
RAVENSWOOD HOSPITAL, Chicago, Illinois
UNIVERSITY HOSPITAL, Omaha, Nebraska
BENSON SWIFT COUNTY HOSPITAL, Benson, Minnesota
SOUTHSIDE HOSPITAL, Bay Shore, L.I., N.Y.
ANOKA T. B. STATE HOSPITAL, Anoka, Minnesota
BINGHAM MEMORIAL HOSPITAL, Blackfoot, Idaho
MOUNT VERNON T. B. HOSPITAL, Mount Vernon, Illinois
PHELPS COUNTY HOSPITAL, Rolla, Missouri
MENOMONIE HOSPITAL, Menomonie, Wisconsin
STATE OF WISCONSIN—GENERAL HOSPITAL, University of Wisconsin
ST JOSEPH'S HOSPITAL, Hancock, Michigan
IVINSON HOSPITAL, Laramie, Wyoming
BYBERRY STATE HOSPITAL, Tubercular Patients Building N-10
NEW MOUND PARK HOSPITAL, St. Petersburg, Florida
HEART HOSPITAL, University of Minn., Minneapolis, Minn.
JUAB COUNTY HOSPITAL, Nephi, Utah
SOMERSET STATE HOSPITAL, Somerset, Penn.
GILLETTE HOSPITAL, St. Paul, Minnesota
GADSDEN COUNTY HOSPITAL, Quincy, Florida
UNIVERSITY OF ILLINOIS, PHYSICAL ENVIRONMENT LABORATORY Urbana, Illinois
CHESTNUT HILL HOSPITAL, Philadelphia, Pa.
UNIVERSITY OF CALIFORNIA, Medical School—Teaching Hospital
PASTEUR MEDICAL BUILDING, Oklahoma City, Okla.
OAKWOOD HOSPITAL, Detroit, Michigan
COLEMAN HOSPITAL, Indianapolis, Indiana
STANISLAUS COUNTY HOSPITAL, Modesto, Calif.
UNIVERSITY OF CALIFORNIA, Virus Laboratory

✱ See SWEET'S Arch. & Eng. Files or: Write for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.



Psychiatric Wards
Nurseries
Laboratories
Psychometric Rooms

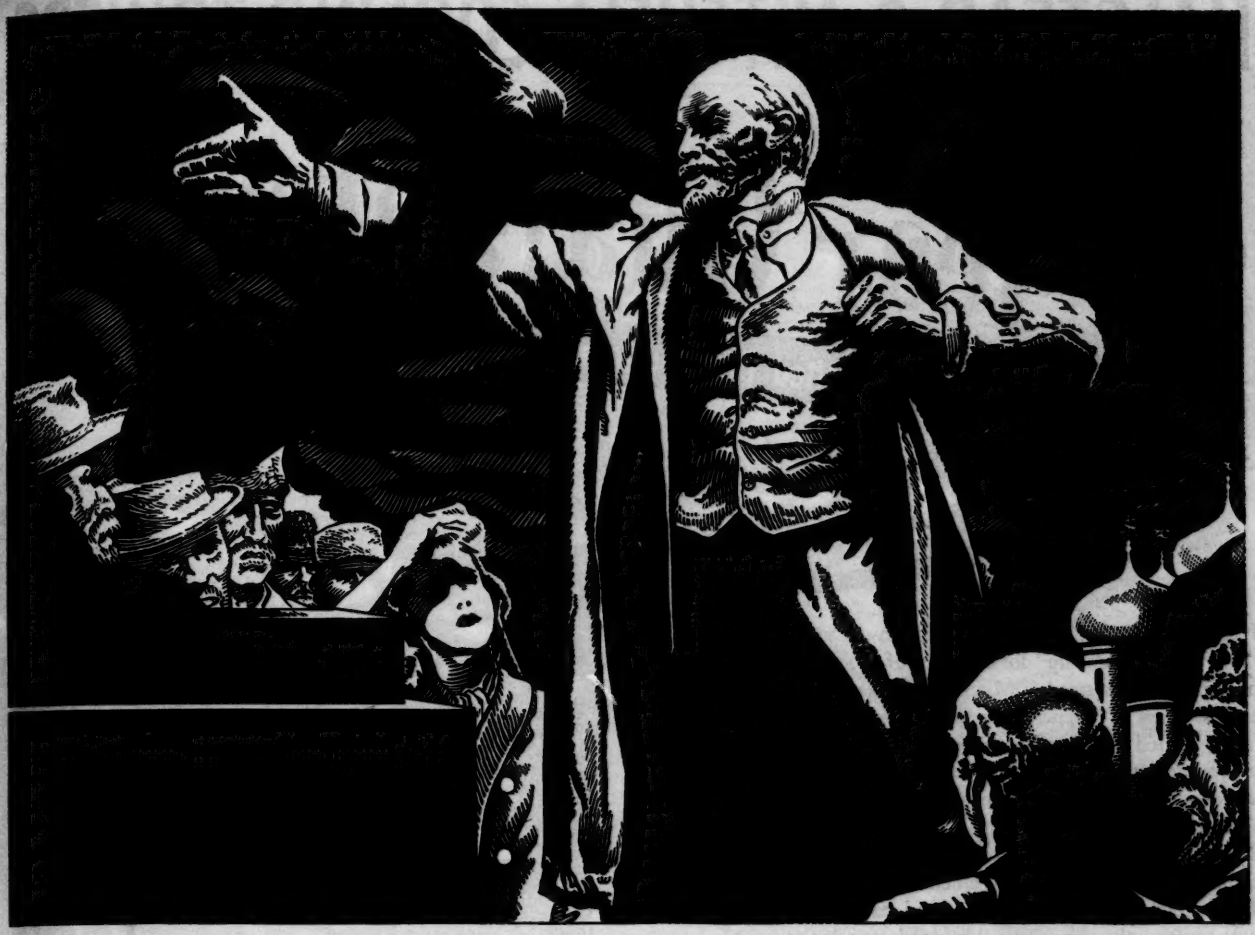
**Multi-Vent Ceiling Panels have been specified for the new addition to the UNIVERSITY OF ILLINOIS RESEARCH AND EDUCATIONAL HOSPITALS, Chicago**
Architects • Holabird, Root & Burgee, Chicago
Consulting Engineers—Psychometric Room and Medicine Research—E. P. Heckel & Assoc., Chicago.

Hospital medical staffs and technicians are rapidly recognizing that the Multi-Vent panel is *the* one air diffuser that can surely meet, even surpass, their rigid air distribution requirements for air conditioning these critical hospital areas.

The success Multi-Vent has achieved in these nurseries, laboratories, operating rooms, etc. of outstanding hospitals throughout the country, is proof of Multi-Vent's ability to provide truly perfect air conditioned comfort in offices, theatres, stores, restaurants and all other types of institutional or commercial buildings . . . where the best in air distribution is desired.

Multi-Vent's unique pressure displacement principle of air distribution is completely free from BLOW or THROW (high velocity injection), the main source of draft hazards . . . thereby eliminating all of the most serious installation, balancing, and adjustment problems inherent in the velocity injection principle upon which all air diffusers except Multi-Vent depend.

**MULTI-VENT DIVISION** THE PYLE-NATIONAL COMPANY
1374 N. KOSTNER AVE., CHICAGO 51, ILL.



# Let us prove this prophet false

***"We shall force the United States to spend itself into destruction."***

These are the words of Lenin, father of Russian Communism. Quoted from page 191, volume xxi, of his Collected Works, they were printed recently in a metropolitan newspaper.

This is the announced goal of the Politburo, and it is the direction in which many patriotic citizens fear we are headed. For example, Congress has just appropriated $87 billion to be spent during 1952, and enacted taxes estimated to produce only $71 billion. The deficit is to be added to our national debt, already $259 billion; and this deficit will depreciate the national currency by another $16 billion.

Part of this stupendous appropriation is to rearm ourselves and the free world against Communist attack. But what about the rest of our spending?... Let us also be realistic. It is time for us as a nation to pause, reflect and consider well. We can do three things to avoid national bankruptcy:

1. Eliminate every non-essential federal expense.
2. Provide taxes to pay all obligations as we go.
3. Pay off some of our national debt every year.

Let every citizen who believes in preserving our nation from the economic termites within, as well as from the announced enemy without, become an active worker to prove the Russian prophet false.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

## The Youngstown Sheet and Tube Company

General Offices -- Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

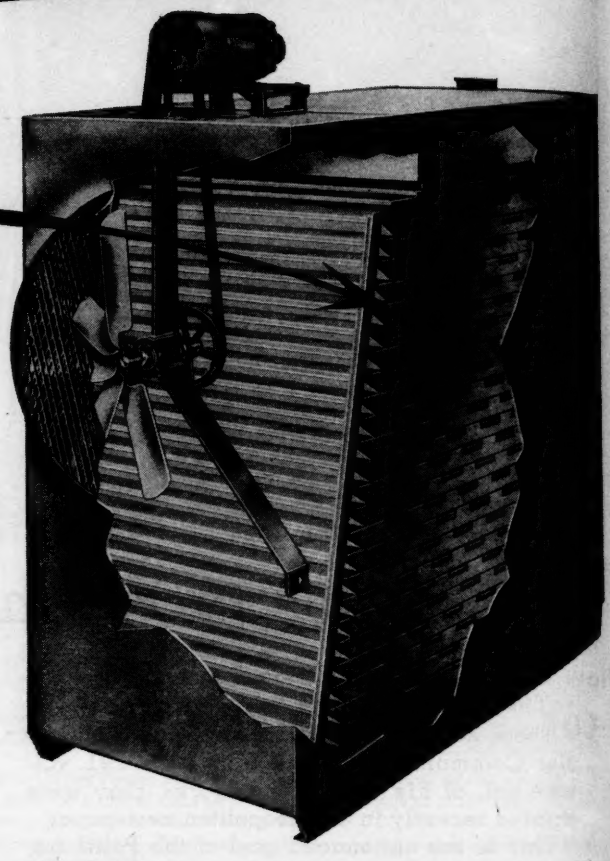
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment

# HALSTEAD & MITCHELL COOLING TOWERS

# 20-Year Guarantee!

On the Wetted Deck Surface of Koppers Pressure-Treated Wood



Here's the industry's greatest cooling tower value . . . "built like a battleship" for 20 years of foolproof performance. Halstead & Mitchell's pioneering in exclusive use of Koppers pressure-treated wood in the wetted deck surface makes possible the unprecedented 20-year guarantee against rotting, and provides the industry's most effective deterrent against fungi growth. Economical, lastworthy . . . the special H & M design for water distribution eliminates, thru the use of an efficient gravity-type distributing pan, extra pumping head required on spray type towers, also cuts down windage losses due to atomizing of water. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service. Easily accessible for cleaning through inlet on back of towers in all sizes.

***MORE EFFICIENT IN ANY INSTALLATION***

H&M # CT-4000 Induced-Draft Cooling Tower supplying the condensing water for 20 HP and 10 HP water-cooled condensing units in 3-story jewelry storeroom air conditioning. Note open-type distributing pan. This installation also has remote water basin in basement for year-round operation.

**5 TONS to 50 TONS**

*A cooling tower for all applications, from 5 to 50-ton capacities—made by Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers.*

***AT LEADING WHOLESALERS EVERYWHERE***

*Write for descriptive bulletin and information on engineering helps.*

**HOUSING**—10 gage (⅛"+) sheet-steel case with 3 coats Bitumastic lining. Electrically welded cabinet. All bolts used are Everdur for ease of disassembly after years of service.

**WATER DISTRIBUTION**—Gravity type distributing pan eliminates extra pumping head, cuts down windage losses, due to atomizing water.

**FAN AND DRIVE**—Quiet-operating stainless steel 8-bladed fan, stainless steel shaft, chrome-dipped rust-proofed pulleys. Cast iron bearing supports. Adjustable belt tension.

HM Halstead & Mitchell

**OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.**

# JENKINS PRACTICAL PIPING LAYOUTS 58

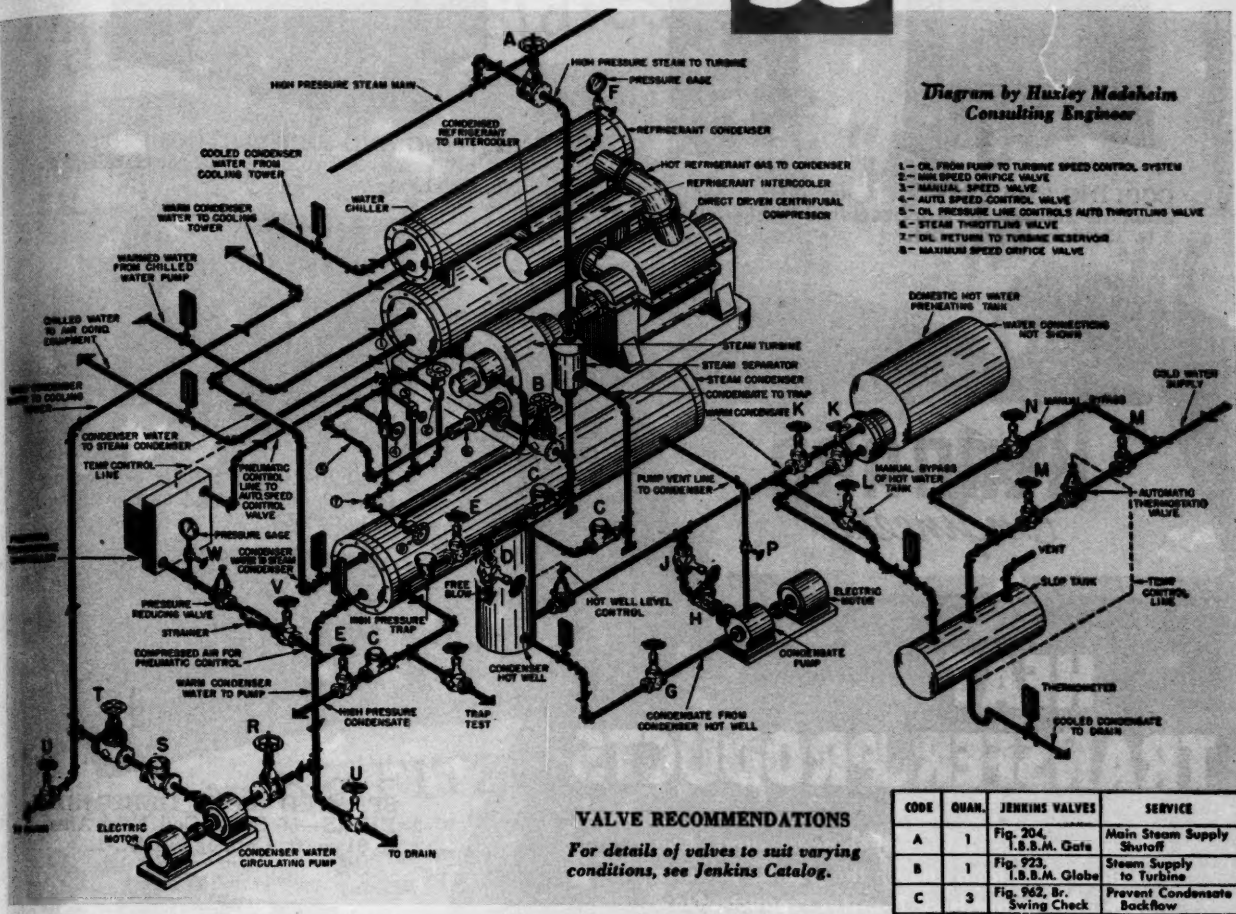



*Diagram by Huxley Madeheim Consulting Engineer*

1.– OIL FROM PUMP TO TURBINE SPEED CONTROL SYSTEM
2.– MIN. SPEED ORIFICE VALVE
3.– MANUAL SPEED VALVE
4.– AUTO SPEED CONTROL VALVE
5.– OIL PRESSURE LINE CONTROLS AUTO THROTTLING VALVE
6.– STEAM THROTTLING VALVE
7.– OIL RETURN TO TURBINE RESERVOIR
8.– MAXIMUM SPEED ORIFICE VALVE

**VALVE RECOMMENDATIONS**

*For details of valves to suit varying conditions, see Jenkins Catalog.*

| CODE | QUAN. | JENKINS VALVES | SERVICE |
|---|---|---|---|
| A | 1 | Fig. 204, I.B.B.M. Gate | Main Steam Supply Shutoff |
| B | 1 | Fig. 923, I.B.B.M. Globe | Steam Supply to Turbine |
| C | 3 | Fig. 962, Br. Swing Check | Prevent Condensate Backflow |
| D | 2 | Fig. 970, Br. Globe | Free Blow and Trap Test |
| E | 2 | Fig. 280, Br. Gate | Trap Shutoff |
| F | 1 | Fig. 703, Br. Needle | High Pressure Steam Gage |
| G | 1 | Fig. 370, Br. Gate | Condensate Pump Shutdown |
| H | 1 | Fig. 92, Br. Swing Check | Prevent Condensate Backflow |
| J | 1 | Fig. 106-A, Br. Globe | Condensate Pump Control & Shutoff |
| K | 2 | Fig. 370, Br. Gate | Preheat Water Tank Shutoffs |
| L | 1 | Fig. 106-A, Br. Globe | Preheat Tank By Pass |
| M | 2 | Fig. 370, Br. Gate | Cold Water Shutoff Valves |
| N | 1 | Fig. 106-A, Br. Globe | Manual By Pass |
| P | 1 | Fig. 741-G, Br. Needle | Condensate Vent |
| R | 1 | Fig. 253, I.B.B.M. Gate | Condensate Water Shutoff |
| S | 1 | Fig. 339, I.B.B.M. Swing Check | Condenser Water Pump |
| T | 1 | Fig. 162, I.B.B.M. Globe | Condenser Water Flow Control |
| U | 2 | Fig. 106-A, Br. Globe | Drain Valves |
| V | 1 | Fig. 106-A, Br. Globe | Prevent Air Supply Shutoff |
| W | 1 | Fig. 741-G, Br. Needle | Pressure Gage Control |

*How to plan*

## CONNECTIONS FOR STEAM TURBINE DRIVEN CENTRIFUGAL REFRIGERATION COMPRESSOR

**As shown in the diagram,** steam from high pressure mains passes through an automatically controlled steam throttling valve which varies turbine speed in accordance with the load on the air conditioning system.

**Control is based upon the temperature** of the chilled water leaving water chiller. A pneumatic controller, positioned by a temperature element in the chilled water discharge pipe, controls air pressure on a diaphragm valve in the oil pressure system.

**This valve controls the pressure** on the steam throttling valve, changing speed of the turbine in accordance with air conditioning load. Exhaust steam from turbine enters the steam condenser which maintains a very low back pressure (26" to 28" vacuum).

**Where district steam is used,** it is generally uneconomical to return the condensate to the boilers; condensate is merely discharged to the sewer after some of the heat has been used to preheat domestic hot water for the building. Local codes specify maximum heat of discharge.

**Jenkins Valves listed** are rated for an assumed high steam pressure of about 160 psi, and the condensing water pressure of about 280 psi.

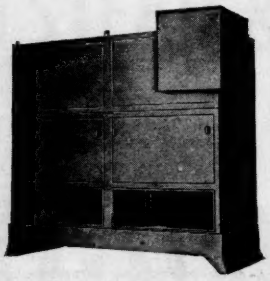
Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

### TO SIMPLIFY PLANNING

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the Jenkins Catalog. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

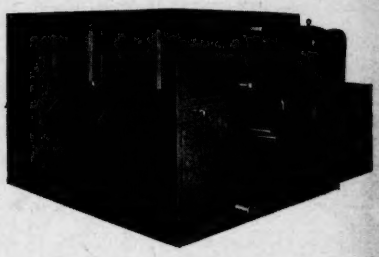
**COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Simply ask for Piping Layout No. 58.**


JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
TRADE JENKINS MARK
Jenkins Bros



COOLING TOWERS—Air Conditioning, Refrigeration, or Industrial Applications. Outdoor-Indoor. 5 to 75 Tons. Catalog 494.

HEATING AND VENTILATING UNITS —Air Volumes 300 to 28,800 CFM. Catalog No. HV-1.



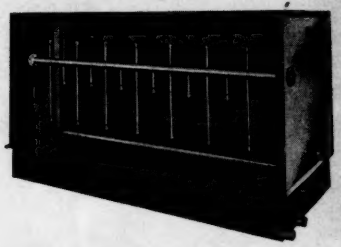
MULTI-ZONE UNITS—Sizes up to 36 sq. ft. Cooling Coil Face Area. Catalog MZ-1.

KENNARD *Engineered*

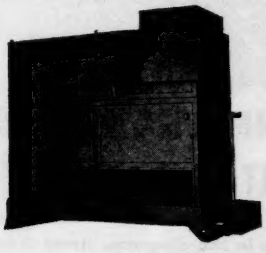
# HEAT TRANSFER PRODUCTS

Architects, Consulting Engineers and Contractors have long known the quality performance of Kennard Heat Transfer Products. Now, more than ever, Kennard is being specified because of the many features frequently found only in Kennard products.

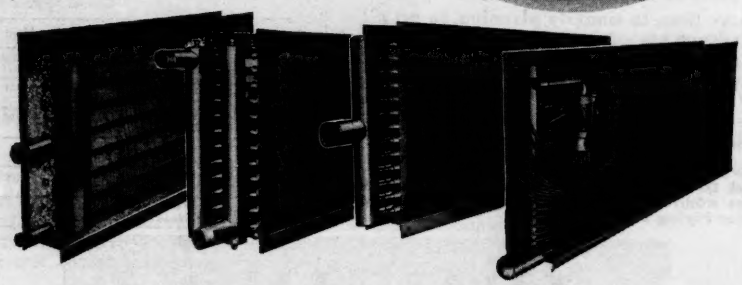
*Specify Kennard on your next job.*



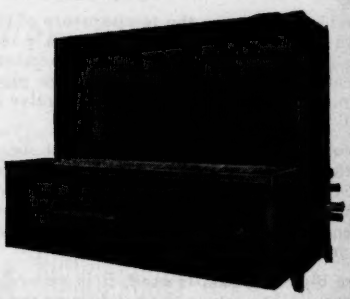
SPRAYED COIL DEHUMIDIFIERS—56 Sizes. Coil Face Areas to 81 sq. ft. Catalog No. SC-1.



EVAPORATIVE CONDENSERS —Indoor-Outdoor. 7½ to 75 Tons. Catalog No. 491.



FINNED COILS—Direct Expansion Coils, Water Coils, Steam Distributing Tube Coils, Standard Steam Coils. Sizes up to 48" wide x 120" long. Catalog No. 47A.



AIR CONDITIONING BLOWER UNITS—13 Sizes. 300 to 21,600 CFM. Horizontal or Vertical. Catalog No. 486.

***Write for name of nearest representative and catalogs needed.***

**KENNARD CORPORATION** • 1823 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

# Vanderveer Estates (BROOKLYN, N.Y.) gets "the best in steel boiler heat"

*Heating Contractor:*
*Harry Barrow Inc.*
*Architects: Kavy & Kavovitt*

## Nineteen big FITZGIBBONS boilers

bring solid comfort to the tenants, and fuel-saving economy to the owners of this fine new development, housing 2600 families. The boilers are the famous "D" Type, selected for large numbers of similar projects and developments on the basis of super-quality performance. Men who know boilers select Fitzgibbons.

The "D" Type Bulletin HV-4 tells why — write for it today.

SEE OUR EXHIBIT
at the Oil Heat Exposition, Philadelphia, Pa. — April 14-18
BOOTH #509

MOST ECONOMICAL IN FUEL — 1884 — THE FITZGIBBONS BOILER
SINCE 1886

**Fitzgibbons Boiler Company, Inc.**
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Manufactured at OSWEGO, N. Y. • Branches in Principal Cities

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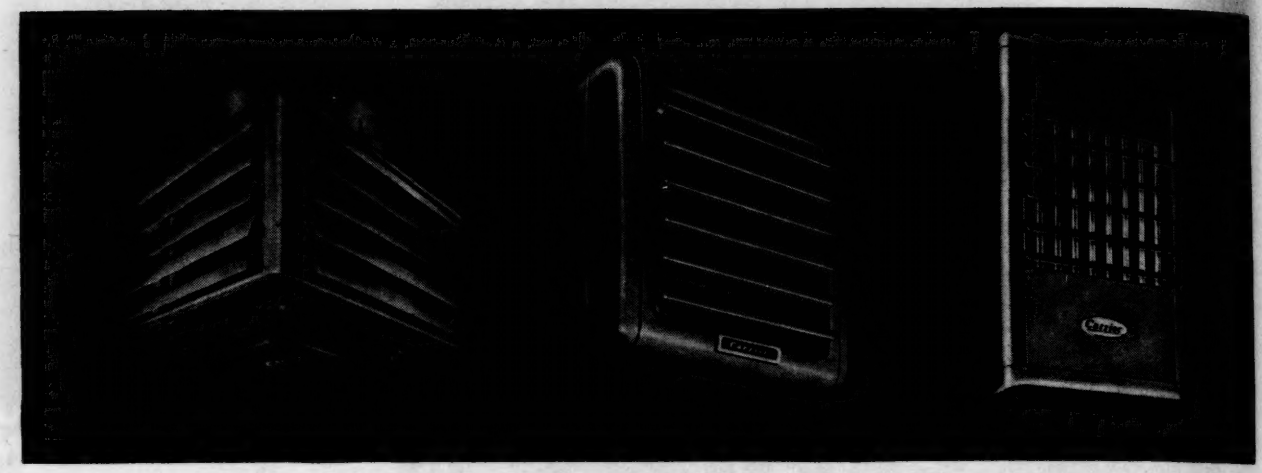
**A steel boiler is a lifetime investment — for "the best in steel boiler heat"—**

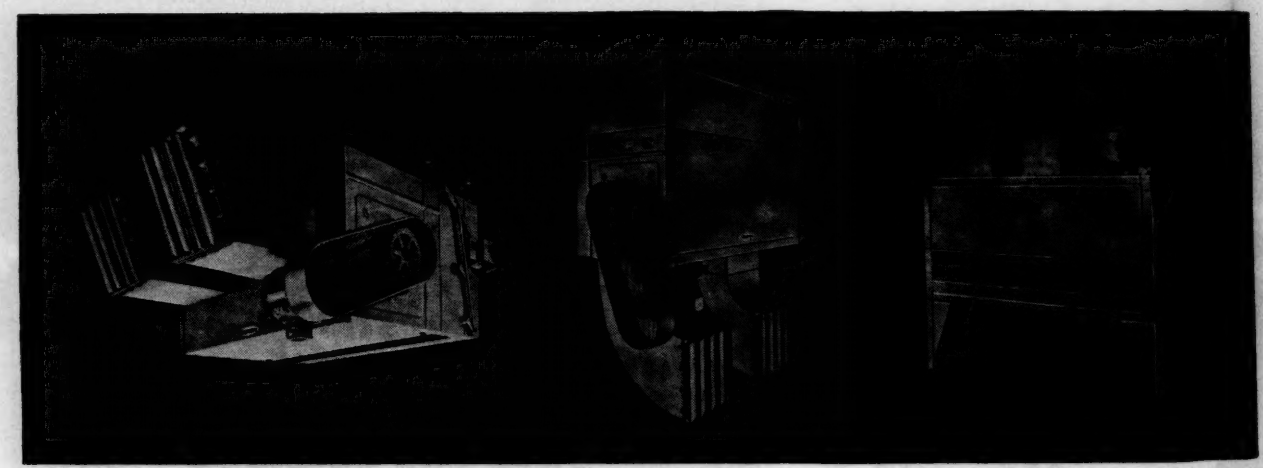
**THE FITZGIBBONS BOILER®**

# Carrier heats big buildings or small

*Any size space can be heated efficiently, economically, with Carrier heating equipment*



**CARRIER PROPELLER-FAN TYPE UNIT HEATERS.** *Four-way, Directed-flo vertical model 46S* discharges warmed air in 1, 2, 3 or 4 directions, at any angle, in any quantity. Gives quick heat from higher ceilings. 7 sizes: 82,000 to 500,000 Btu's. Steam or hot water. *Horizontal model 46U* is attractive, quiet, rugged. Ideal for wall installations. Single-row Aerofin heating coil with widely spaced fins offers less air resistance, makes cleaning easier. 10 sizes: 21,000 to 200,000 Btu's. Steam or hot water. *Gas-fired models 46T, shown, and 46TD (duct type)* supply clean, economical heat wherever gas is available—offices, factories, stores, etc. Both feature one-piece heat exchanger and combustion chamber of Aluminized Steel. 7 sizes: 70,000 to 230,000 Btu's. AGA-approved for all types of gas. *Write Carrier Corporation, Syracuse 1, N. Y., for the folder, "Unit Heaters."*



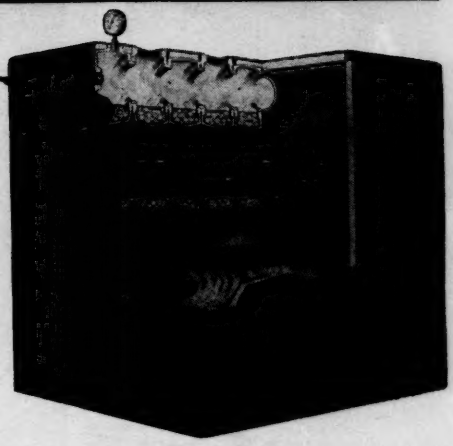
**CARRIER BLOWER TYPE HEAT DIFFUSERS 46P,Q,R** heat and ventilate larger enclosed areas in garages, hangars, warehouses, factories, etc. Multiple discharge outlets with adjustable louvers deliver air in practically any direction. Floor, wall or ceiling mounted. Sectionalized for easy handling—quickly altered to fit changing requirements. 7 sizes, to 1,720,000 Btu's. Air-handling capacities from 4000 to 25,000 cfm. Steam or hot water.

Carrier

*The Unit Heater Industry is proud of the recognition accorded it by the armed services and procurement departments of the United States Government. Proven in grueling use during World War II, unit heaters are now standard equipment in ships, plane hangars, living quarters, garrison buildings—wherever reliable, efficient heat is necessary for the completion of a task or the well-being of our fighting forces. On the home front, unit heaters serve equally important roles in industrial plants producing war material supplying the needs of the allied forces.*

**AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING**

# AMERICAN-Standard
## HEATING

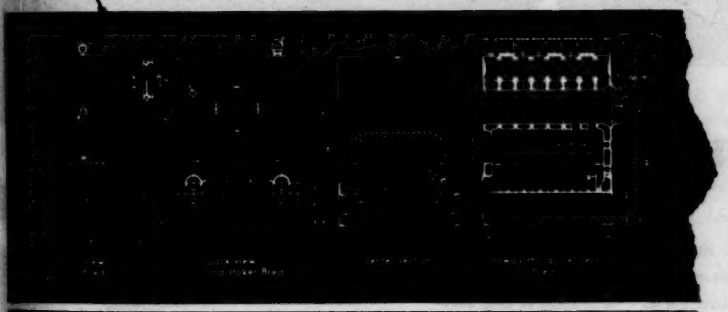


## Improved design makes New No. 3 REDFLASH Boiler *better than ever!*

● Incorporating a heat-saving combination of finned heating element, correctly designed baffles, and long flue travel, the *new* No. 3 Redflash is an even greater boiler than before.

Made in models and sizes to meet the heating requirements of large homes, apartment houses and commercial establishments, these durable cast iron boilers can also be installed in battery to provide an extremely flexible heating plant for larger buildings. Available for steam or hot water heating, No. 3 Redflash burns all fuels. American-Standard heating equipment is sold through selected wholesale distributors to heating and plumbing contractors.

## *Quality Construction! Precision Engineering!*



The new No. 3 Redflash is carefully designed and sturdily constructed for many years of completely automatic, carefree service. Note these important features as illustrated above:

Large disengaging area provides dry steam for fast, noiseless heating. Finned heat absorbing surface exposed directly to fire for extra efficiency. Refractory baffles bring hot flue gases into intimate contact with finned crownsheet. Scientifically designed and proportioned combustion space for greater efficiency. Flue passages provide exceptionally long flue travel and extract maximum heat from hot gases.

**DIMENSIONS, OUTLETS, INLETS**
Tapped 2" for External Water Heater

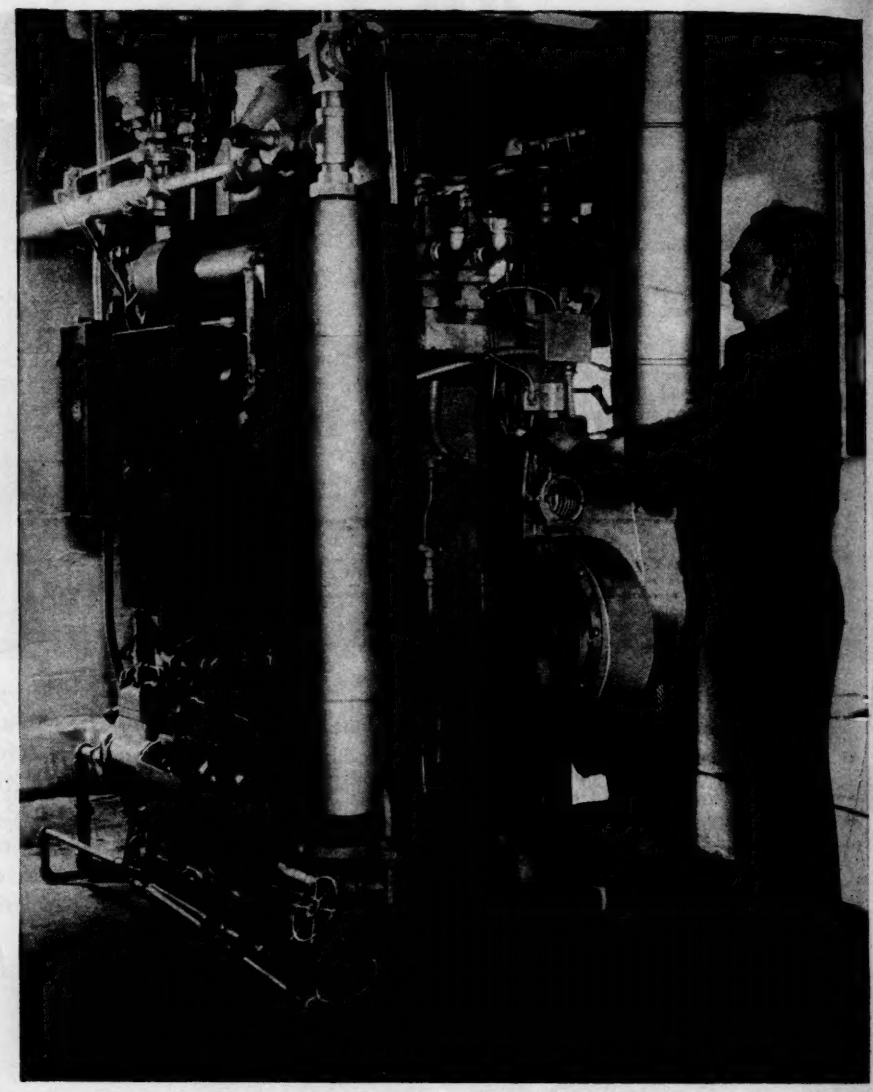
| BOILER NUMBER | | Outlets Number and size | Inlets Number and size | DIMENSIONS—INCHES | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Steam | Water | | | B | C | D | E | F | G | H | L† |
| 3-S-6* | 3-W-6* | 2 4" | 2 5" | 18 | .. | .. | .. | .. | 9 | 29⅜ | 36 |
| 3-S-7* | 3-W-7* | 3 4" | 2 5" | 12 | 12 | .. | .. | .. | 9 | 35⅜ | 42 |
| 3-S-8 | 3-W-8 | 3 4" | 2 5" | 18 | 12 | .. | .. | .. | 9 | 41⅜ | 48 |
| 3-S-9 | 3-W-9 | 4 4" | 2 5" | 12 | 12 | 12 | .. | .. | 9 | 47⅜ | 54 |
| 3-S-10 | 3-W-10 | 4 4" | 2 5" | 12 | 12 | 12 | .. | .. | 15 | 53⅜ | 60 |
| 3-S-11 | 3-W-11 | 4 4" | 2 5" | 12 | 18 | 18 | .. | .. | 9 | 59⅜ | 66 |
| 3-S-12 | 3-W-12 | 5 4" | 2 5" | 18 | 12 | 12 | 12 | .. | 9 | 65⅜ | 72 |
| 3-S-13 | 3-W-13 | 5 4" | 2 5" | 18 | 18 | 12 | 12 | .. | 9 | 71⅜ | 78 |
| 3-S-14** | 3-W-14** | 6 4" | 2 5" | 12 | 12 | 18 | 12 | 12 | 9 | 77⅜ | 84 |

*Coal, hand fired only. **Oil Fired (3-S or W-14-0) and Stoker (3-SC or WC-14) only.
†On Hand Fired add 21" to length for Smoke Hood. On Oil and Stoker Fired add 3½" for Smoke Collar.

*The* AMERICAN-Standard *line means more business for you in '52!*

**American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.**

*Serving home and industry*



*Why not—*

# make your steam *where you use it?*

You buy a boiler 15 or 20 feet square (or more) and just as high, and chances are you don't have room to install it very near to the places — often widely separated — where steam is to be used. So what do you do? You install, insulate and maintain expensive steam lines from the place the steam is produced to its point of use and then you continue to pay for inevitable condensation losses which can only mean higher steam costs.

Why?

Well, for one reason — some situations may make that the only practical way to do the job. *But* — in a great many instances you'll make a big saving in time, space and money by selecting the C-E Re-circulation Steam Generator — the unit that permits you to make steam *where* you *use* it.

If you have a space 7 feet square and about that high, that's all you need to set up the C-E Re-circulation Steam Generator. It's more than a "package" boiler — it's a complete steam plant including all controls and auxiliaries — a fully integrated unit — producing up to 6,000 pounds of steam per hour.

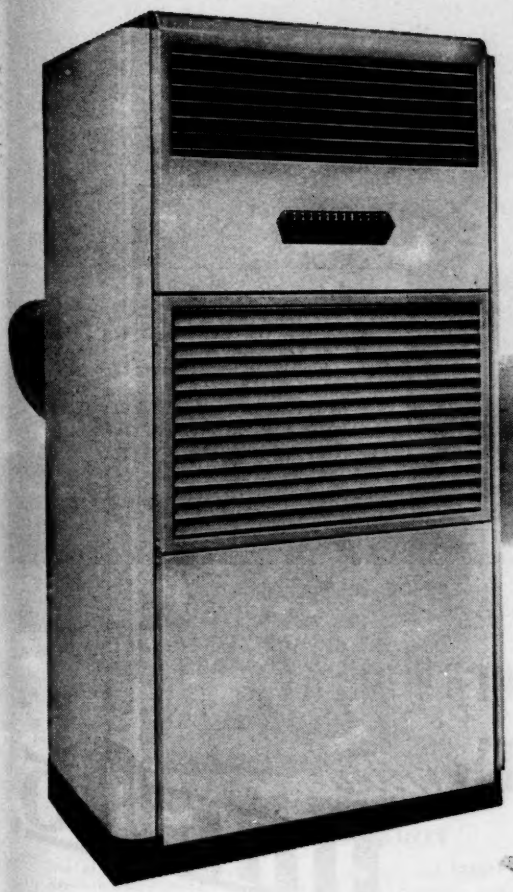
So — if you need steam . . . for continuous or intermittent load . . . for heating or processing — or both . . . for a location in your plant not now served by your existing boiler plant . . . for an occasional demand which exceeds the capacity of present boilers — if you want any or all of these, plus the advantages of maximum output from minimum space, then your best bet is the C-E Re-circulation Steam Generator. Don't buy any boiler in its capacity range until you investigate C-E. B-523

C-E

**COMBUSTION ENGINEERING — SUPERHEATER, INC.**

200 Madison Avenue, New York 16, N. Y.

# There's a superb WESTINGHOUSE UNITAIRE® CONDITIONER



## in the size you need...

## available now...

... through your Westinghouse Air Conditioning Distributor. The UNITAIRE is completely factory-assembled and ready for use. Installation is simple and fast. It does not require hard-to-get materials. These units are adaptable, too. They can be applied singly or in multiple to condition anything from a single room to an entire floor or building.

Best of all, the UNITAIRE is the best looking, most reliable air conditioner you can buy. One reason is the famous Westinghouse hermetically-sealed compressor. There are other important reasons your Westinghouse Air Conditioning Distributor will be glad to explain. Call him today; he's listed in the Yellow Pages of your telephone directory. Or, write for free booklet to Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Mass.

*For* OFFICES
STORES • FACTORIES
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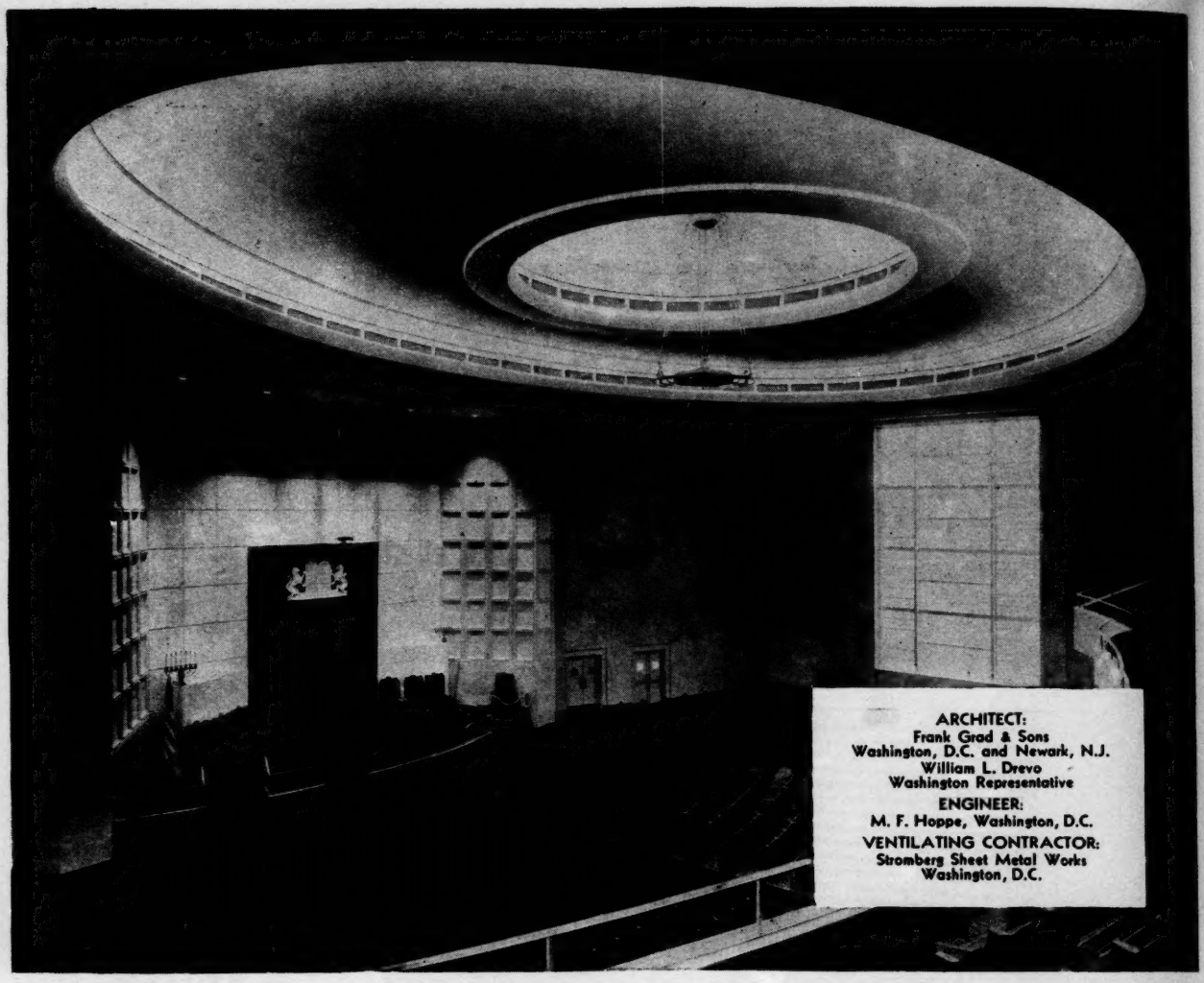
YOU CAN BE SURE...IF IT'S Westinghouse



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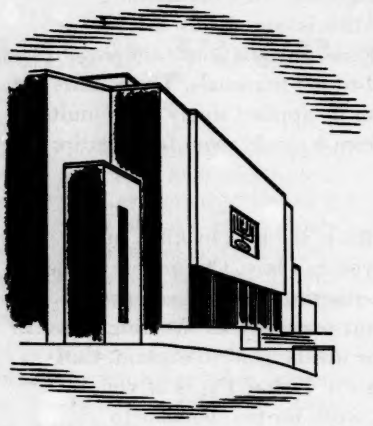


# Dignity, Decoration and PRACTICALITY *with* uni-flo®

In the new synagog of the Adas Israel Congregation, in Washington, D.C., continuous lines of Barber-Colman UNI-FLO grilles are installed around the ceiling coves, as shown above, to serve *three* purposes. First, they provide outlets for the ventilation system. Second, the continuous lines enhance the beauty and dignity of the decorative scheme. Third, the problem of changing fluorescent light tubes and cleaning cove lighting troughs was solved by a special Barber-Colman hinged grille design. This distinctive unit can be swung up to permit easy accessibility. *Another example of Barber-Colman engineering versatility.*

BARBER COLMAN

**BARBER-COLMAN COMPANY • 1224 ROCK ST., ROCKFORD, ILL.**

# "HET UP" about YOUR wasteful heating SET UP?

## Why not change to

# THERMOLIER

## UNIT HEATERS

If you're dismayed about *last winter's* high-cost-of-heating, how about next year — when it may be as hard to get *fuel*, as it was for you to get *heat* this year?

Here's a red-hot tip. To save heat and fuel, install Thermolier Unit Heaters. But don't delay. Material shortages can seriously disrupt the production of unit heaters. In addition, skilled men are available to make installations now. They may not be in the days ahead. Study these Thermolier Unit Heater advantages — *and act promptly.*

**HEATING COMFORT** Thermoliers provide quick heating from a cold start. Desired room temperatures are easily maintained within a close range.

**LOW FIRST COST** Thermoliers are so efficient and so compact that their heating capacity is often equivalent to the capacity of cast iron radiation or pipe coils of twice the cost.

**ECONOMY OF OPERATION** Heat is forced down to the working level . . . not banked uselessly at the ceiling level.

**ADAPTABILITY TO EQUIPMENT AND FLOOR LAYOUT** Thermolier unit heating is widely used in industrial plants and warehouses, garages, stores and public buildings. The units and the simple piping are overhead where they do not interfere with arrangement of the operating machinery or equipment.

### THERMOLIER CONSTRUCTION FEATURES THAT SAVE MONEY

Use of plain thermostatic trap, the simplest and least expensive kind of trap, is practical because of Thermolier's exclusive internal cooling leg.

Maximum capacity provided at all times and annoying, destructive water hammer eliminated by built-in pitch of tubes and internal cooling leg which assures continuous drainage of condensate.

Damaging strains caused by expansion and contraction eliminated by "U" type expansion tubes.

Safety and durability assured with leak-proof tube-to-header construction.

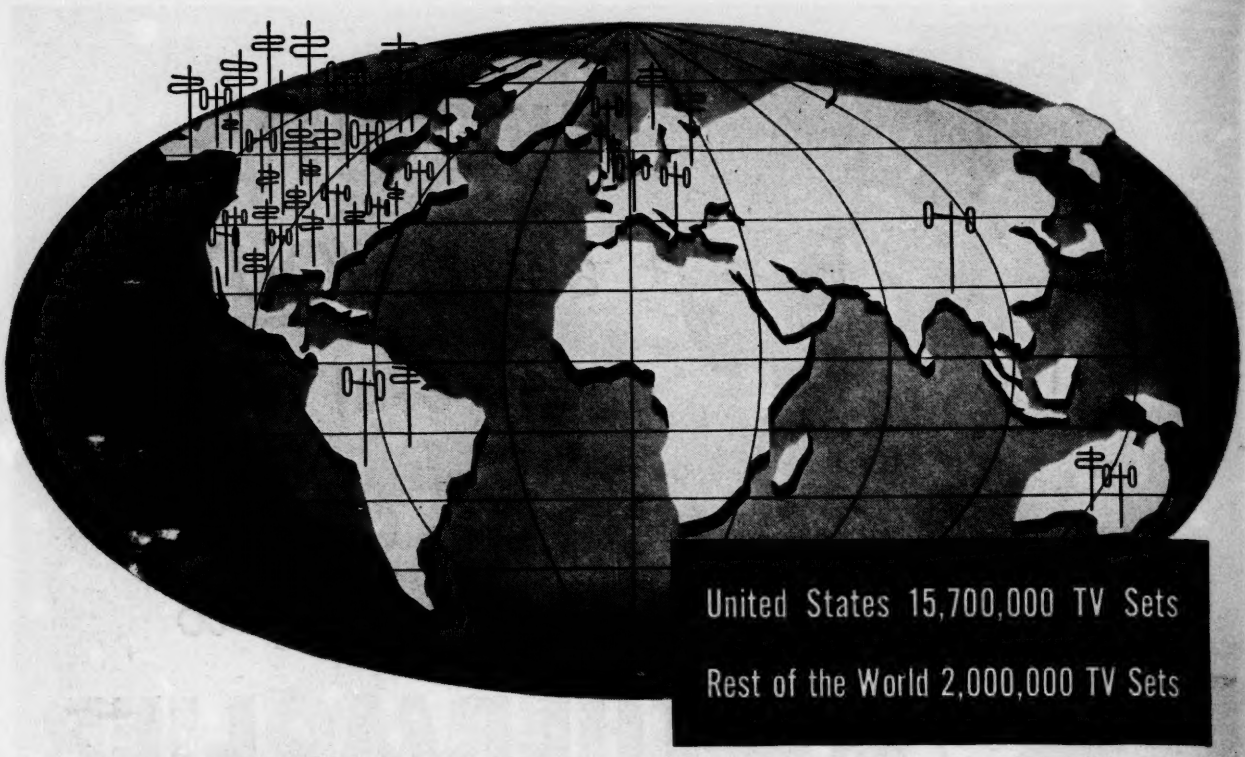
Eight other important features. Write for Thermolier Catalog.

Horizontal Delivery | Textile Model | Velocity Nozzle | Vertical Delivery

# GRINNELL

**WHENEVER PIPING IS INVOLVED**

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane




# COMPETITION Turns Luxuries into Necessities

To millions of people throughout the world, washing machines, radios and television sets are miraculous inventions remote from their lives . . . for the wealthy only.

In the United States, however, a new product appears in no time in the homes of wage earners as well as salaried executives.

Consider television, for example. Only 6,500 sets produced in 1946 . . . over 5,000,000 in 1951. Or washing machines . . . more than 24,000,000 in 10 years.

### What has Competition to do with this?

Do you think we'd continue to get more and better products if only one company made each item or each line?

No! We get more and better products here in America, because anybody who thinks he can make anything better or sell it more efficiently is free to try.

And many succeed. Take electrical products like radios and television sets . . . and home appliances like washing machines and electric fans. Does the biggest company monopolize this industry? Not by a long shot! Even counting all its affiliated companies, it still sells less than 1/5 of such products bought in this country.

There are nearly a thousand other companies that make home appliances, radios and television sets. And they do more than 4/5's of the business! The smallest of them make the biggest companies hustle their bones to keep making products better and better.

In America, a better product can always win consumer acceptance in any field.

### Let's keep the COMPETITIVE SYSTEM working for us

The Competitive System can be killed! When industries are run by government, when taxes are so high that they destroy the incentive to work hard and risk savings in business ventures, the Competitive System languishes and dies.

You've seen it happen in other lands. Let's not let it happen here.

Let's all of us watch closely to see that those who represent us in government are working with us and for us to preserve our Competitive System; to assure a tax structure that leaves enough incentive to make hard work worthwhile, so that *any* man with ability and energy has a chance to earn good money and keep most of it.

Competition thrives best where the rewards are high. People live best where competition thrives.

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**THE COMPETITIVE SYSTEM DELIVERS THE MOST TO THE GREATEST NUMBER OF PEOPLE**

**THE NEW**
**DOUBLE-FLOW AQUATOWER**
**50 tons or more capacity**

The only *complete* line of "packaged" water cooling towers is the AQUATOWER line. In the 2 to 6 ton range, Marley offers Model 23 and 33 Aquatowers —small, compact units that soon pay for themselves in any service requiring as little as 6 gpm.

For intermediate capacities, you can choose from 8 standard size Aquatowers that fit any cooling requirement in that capacity range, indoors or out.

On jobs requiring 50 or more tons of refrigeration, Marley offers the NEW DOUBLE-FLOW AQUATOWER, the lowest silhouette, lowest pumping head tower. In this newest cooling tower, one fan utilizes air from two completely open sides, combining great efficiency and power economy.

Aquatowers in all sizes conform to building codes. Small and medium-sized units are shipped completely assembled and Double-Flow Aquatowers are prefabricated for ease of construction.

For complete information, call the Marley representative in your city or write for Bulletin AQ-52.

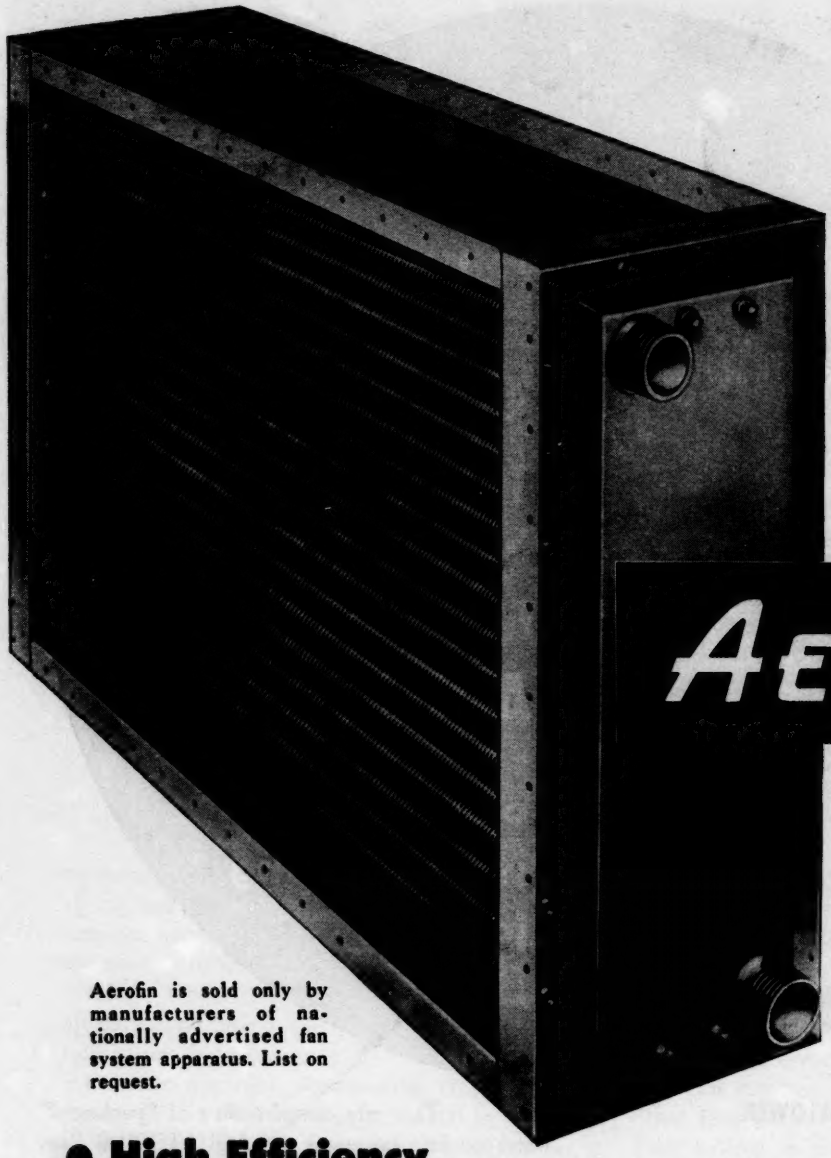
producers of
DOUBLE FLOW TOWERS
DRICOOLERS
AQUATOWERS
NATURAL DRAFT TOWERS
CONVENTIONAL TOWERS
SPRAY NOZZLES
VAIRFLO TOWERS
DOUBLE FLOW AQUATOWERS

MARLEY

**The Marley Company, Inc.**

WORLD'S LEADING PRODUCER OF WATER COOLING TOWERS

Kansas City 5, Missouri



# AEROFIN

## Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

**● High Efficiency**

**● Long Service Life**

**● Low Maintenance Costs**

You are assured of high efficiency in heating or cooling — long service life — low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively* — offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research — and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

**AEROFIN CORPORATION**
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# LADISH

*Controlled Quality*

## PIPE FITTINGS

reduce piping assembly time

**Makeup goes smoother... with less chance for delay... on those piping systems where Ladish fittings are installed. Ladish Controlled Quality makes the difference. By exacting controls over materials and manufacturing processes... Controlled Quality assures uniform weldability through metallurgical integrity, fast assembly through dimensional accuracy and provides a real assurance of ultimate operating economy and complete dependability... reasons why it pays to specify LADISH.**

TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
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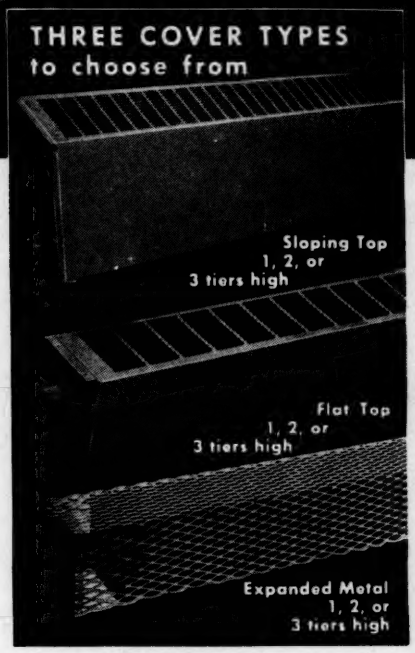



## low level cost...
## all level comfort...
## with DUNHAM *FIN-VECTOR* RADIATION

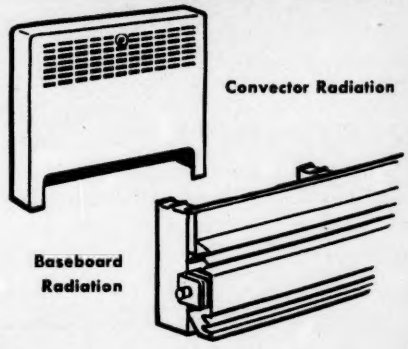
Put Dunham Fin-Vector Radiation near the floor, under windows, or *at any height* along outside walls . . . and you're sure to get the heat you need—for less.

**Better Heat Distribution.** Materials used are those best suited for rapid heat transfer. Heating elements may be installed one, two, or three tiers high to assure effective heat distribution.

**Economical to Install.** Light in weight, Fin-Vector requires few supports . . . is easy to handle. Choice of covers and heating elements in numerous sizes and types greatly reduces on-the-job cutting; speeds assembly.

No matter *what* you require in radiation equipment . . . Dunham can help you. In addition to Fin-Vector and space-saving Baseboard Radiation, Dunham offers a complete selection of Convectors—including special institutional types.

For further information on Dunham Fin-Vector Radiation, write for Bulletin 1251-16. Similar literature available on other products.

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400 West Madison Street, Chicago 6, Illinois
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**heating systems and equipment**

**Vari-Vac Differential Heating • Baseboard Radiation**
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# Streamline®

## SOLDER TYPE GATE VALVES

## for dependable, long lasting service

See your jobber for further information or write for catalogs S-351 and W-251 describing our complete line of STREAMLINE wrought copper and cast bronze fittings.

The new Streamline solder-type gate valve is built for durable operation in the 125# steam working pressure class of general service.

Its engineering design was perfected after many months of testing. Careful machining of seat and wedge disc gives positive shut-off with light pressure. Special lug design eliminates the possibility of installing disc backwards. And, non-rising stem allows installation in minimum amount of space.

The Streamline gate valve, which is furnished in a complete range of sizes from ½" nominal through 2" nominal, is an extremely rugged, seep-proof unit that will withstand the most severe usage and yet consistently give positive shut-off. Get the full facts today.

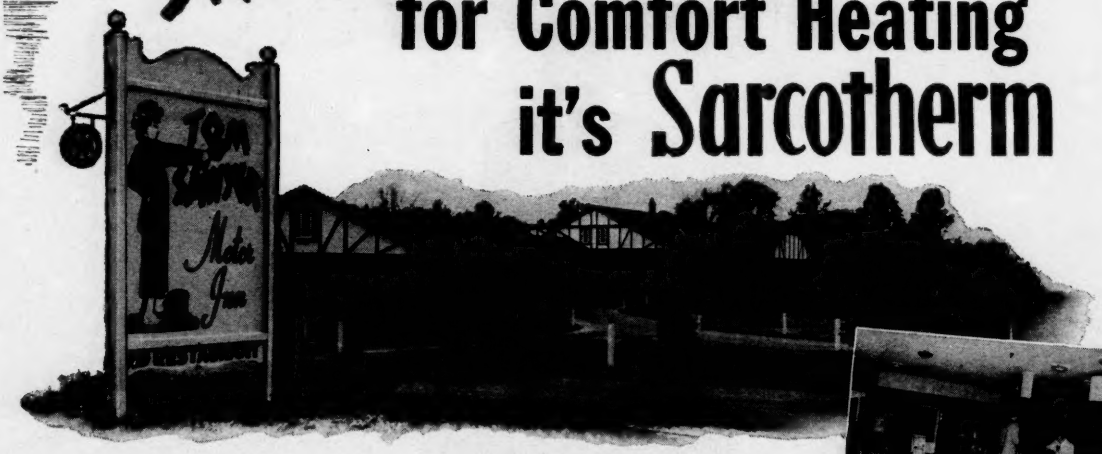
Streamline fittings are available in a complete range of standard sizes.

71

STREAMLINE PRODUCTS

**MUELLER BRASS CO.** PORT HURON 2, MICHIGAN

# In Motor Courts too!
## for Comfort Heating it's Sarcotherm




Tom Sawyer Motor Inn, Albany, N. Y., 100 rooms with 100 baths. Highly rated by A.A.A. . . . Radiant Heating System designed by LeValley-McLeod, Inc. of Schenectady, and installed by A. J. Eckert Co., Albany, N. Y. . . . includes 5 zones—completely Sarcotherm equipped.

Today the luxurious motels which are rapidly displacing the old overnight cabins along our highways from coast to coast, include central heat among the hotel comforts offered.

Heating of the one-story, spread-out buildings is usually by forced hot water or radiant means, for which

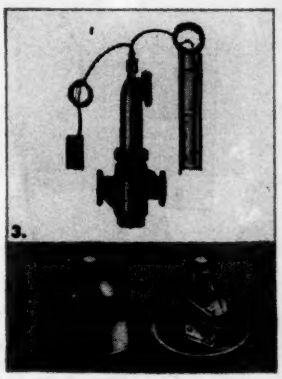
**SARCOTHERM**

weather-compensated temperature control with continuous circulation is unequalled.

We have pioneered in this field and our experience is at the disposal of architects and engineers who are designing motor courts and wish to include the latest in automatic heating. Here are a few of the Motels recently equipped with Sarcotherm Controls:

Newberry Motel, Russelville, Ky.
Miami Courts Tourist Cabins, Salisbury, Md.
Hotel Sleep, Rahway, N. J.
Garden Motor Lodge, Troy Hills, N. J.
Dutch Maid Motor Lodge No. 2, Woodbridge, N. J.
Smith's Tourist Court, R.F.D., Lynchburg, Va.
Van Winkle Motel, Everett, Washington
Snyder's Court, North Bend, Washington
Leonard Auto Court, Parkland, Washington

1. Main Lobby and Registration Desk at Tom Sawyer Motor Inn.
2. Friends meet at the main entrance in the atmosphere of an exclusive country club.



3. The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.
4. The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

**SARCOTHERM CONTROLS, INC.**

Empire State Bldg., New York 1, N. Y. • Represented in principal cities

A SARCO PRODUCT

23

NABISCO

# *selects* SARCO

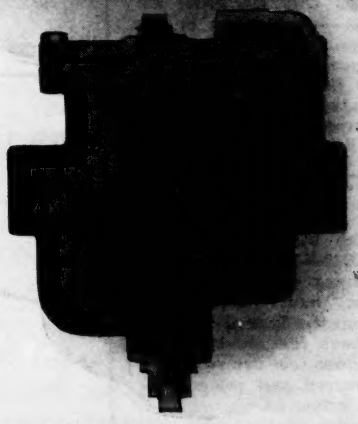
## For LARGEST BAKERY on the Pacific Coast

This beautiful, modern bakery just completed by National Biscuit Company in Portland, Oregon, features many innovations. For example, the large tower at left is designed for the storage of raw materials. Each baking unit measures over 600 feet from cutting machine to packing department. The new plant greatly augments NABISCO's service to food merchants and consumers in the expanding Pacific Northwest.

*Four types of SARCO STEAM TRAPS are used*

Sarco furnished, for the heating system, four different types of steam traps, including a large number of the inverted bucket type as illustrated.

Efficient steam trapping, of course, depends upon the selection of the right type of trap for the particular job. Sarco is the only manufacturer offering a selection of four major types of steam traps, namely: inverted bucket, thermostatic, float-thermostatic and liquid expansion. Write for trap selection chart No. 1600.



SARCO INVERTED BUCKET STEAM TRAP

Since 1936 made with built-in strainer.
All mechanism on cover for easy inspection.

Engineers & Architects: Ford, Bacon & Davis, New York.
Contractors: Buchanan Co., Inc., Portland, Oregon

No. 334

SARCO SAVES STEAM

**SARCO COMPANY, INC.**
*Represented in Principal Cities*
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

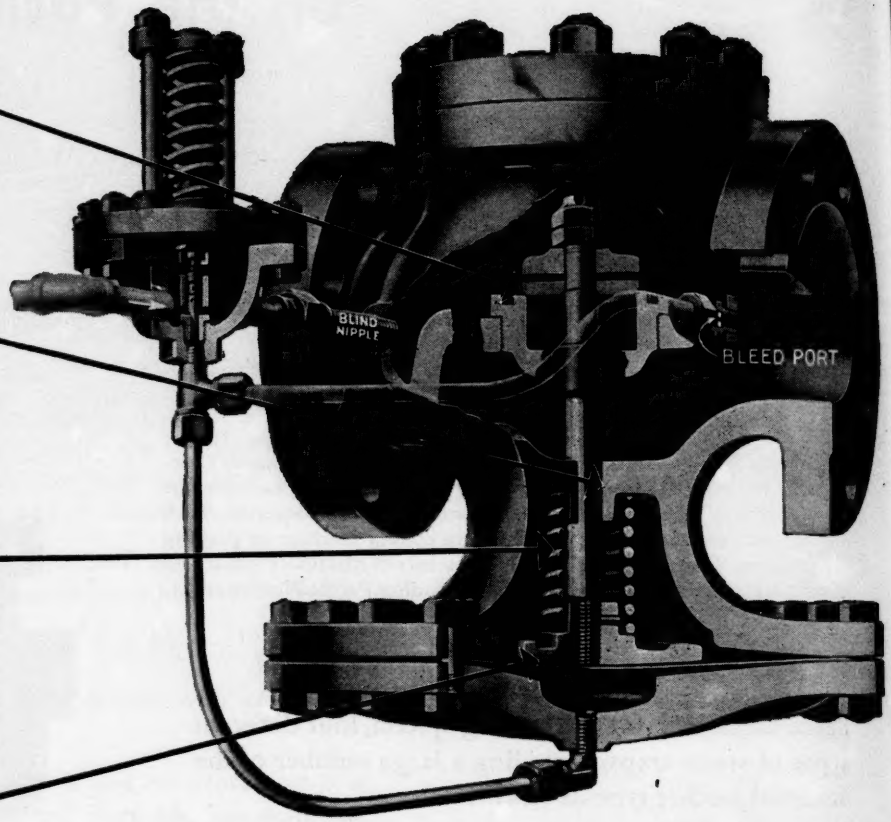
# WHY Spence Regulators Outlast The Field

**SECO METAL SEATS AND DISCS** — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

**PACKLESS CONSTRUCTION** — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

**SPRING OUT OF PATH OF STEAM** — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

**LARGE BALANCED DIAPHRAGM**—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.




Spence Type EQ back pressure regulator-operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

**DURABILITY** — Spence Regulators perform dependably year after year.

**ACCURACY** — You can be sure of accurate control for the life of the regulator.

**MAINTENANCE** — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

ER-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

Spence

# Are you overlooking a 3-way saving?

FORD MOTOR COMPANY ISN'T. When its Aircraft Engine Division in Chicago took over America's largest manufacturing plant (100 acres under roof!), it was found that additional heating would be needed for locker and washroom areas. Figured conventionally, this would have meant an extra 21,000 lbs. of steam per hour added to existing boiler capacity.

However, the installed heating system was mechanically circulated warm air. This permitted Ford to incorporate Dorex Air Recovery and so recover and *reuse more than half* the heated air. Result: a three-way saving—

1) *A saving in critical material.* With Dorex Air Recovery the need for outside air tempering and reheat coils was *entirely eliminated*. 2) *A worth-while dollar saving.* The cost of Dorex Air Recovery was only about one-half the original estimate for extra boilers and coils—a saving of over $40,000 on initial equipment. 3) *A saving in operating cost.* Because of the smaller boiler capacity required with Dorex Air Recovery, Ford estimates a saving of some 2,500 tons of coal per year.

These savings are typical of those enjoyed by Dorex users everywhere—as evidenced by more than 10,000 Dorex installations over the past twenty years.

Let us give you full information about Dorex Air Recovery—how it works, who uses it, what you can expect it to save you. Write us today.

DOREX TRADE MARK "DOREX" REG. U.S. PAT. OFF.
*Air Recovery*

**W.B. CONNOR ENGINEERING CORP.**
Danbury, Connecticut
*Air Diffusion • Air Purification • Air Recovery*
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

**W. B. CONNOR ENGINEERING CORP.**
**Dept. B-42, Danbury, Connecticut**

Please send me, without obligation, full information on Dorex Air Recovery.

Name.....

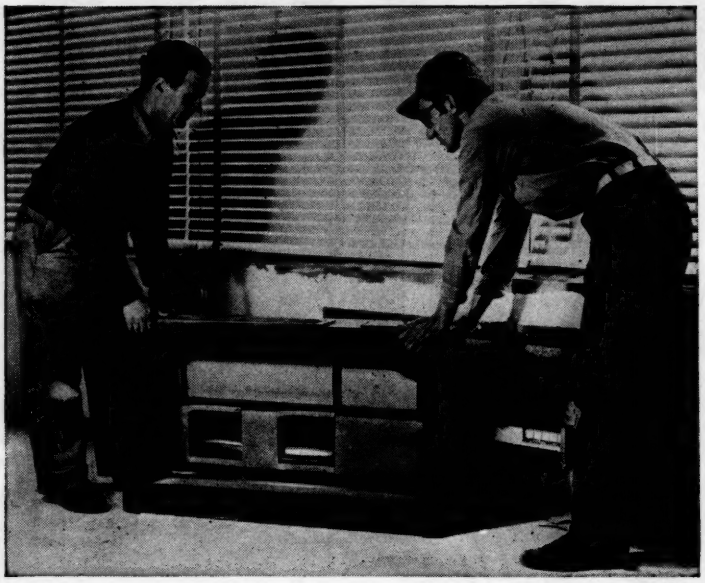
Position.....

Company.....

Street.....

City.....Zone.....State.....

# YORK *Unitary* AIR CONDITIONING



## A Major Advance in Multi-Room, Multi-Story Air Conditioning

*York Unitary Air Conditioning is a system of individually controlled unit room air conditioners for heating or cooling, with water from a central point.*

**Lower Installation Costs**

York Unitary Air Conditioning can be installed in existing buildings where space is at a premium or the cost of ductwork prohibitive—or in buildings under construction where the required number of units can be installed more economically than a central system.

Only three pipes are required—water supply and return, and drain. To facilitate piping, both right and left hand units are available. Each York Unitary Air Conditioner has an outside air plenum which allows you to locate the outside air intake anywhere from window sill to floor level.

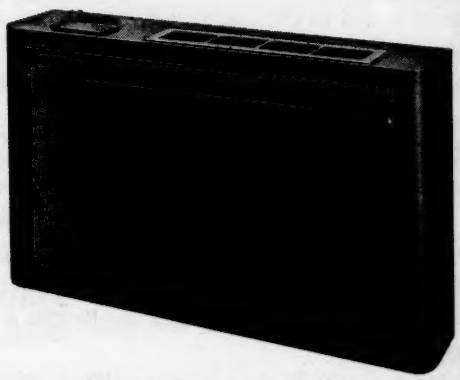
**Lower Operating Costs**

Each York Unitary Air Conditioner has its own controls. During holidays, weekends, nights when only a few tenants are present, only part of the system need be operated to condition the spaces actually occupied. Cleaning and redecorating costs are kept to a minimum because all air—recirculated as well as outside air—is filtered.

**Minimum Space Required**

In the engine room, only space for a central water cooling system is needed. No air handling equipment is necessary. In the rental area, the compact York Unitary Air Conditioner takes up little space . . . can be partially recessed into the wall.

Your nearby York Representative will be glad to show you how this latest York advance in more economical, more efficient air conditioning can save you time and details . . . save your client money and space. See him today or write York Corporation, York, Pennsylvania.



**York Unitary Air Conditioner**

Model CF-300 illustrated. Built in sizes with capacities from 5000 to 14,000 Btu's/hr. Contain direct connected centrifugal fans, water coils, and filter. Factory assembled and tested.

York refrigeration air conditioning

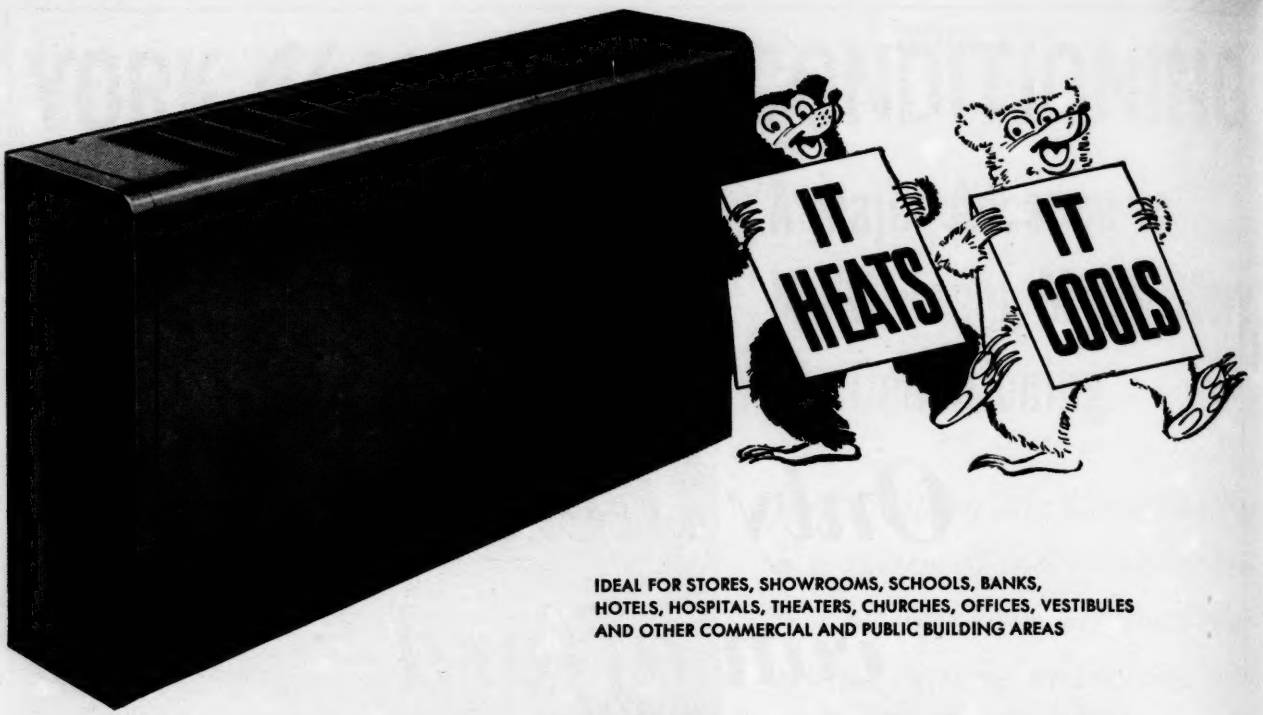
**The big advances come from YORK**

*Headquarters for*— **Refrigeration and Air Conditioning**

# *Only the Rich can afford poor heating!*

**McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.**

*Doing One Thing Well*




**IDEAL FOR STORES, SHOWROOMS, SCHOOLS, BANKS, HOTELS, HOSPITALS, THEATERS, CHURCHES, OFFICES, VESTIBULES AND OTHER COMMERCIAL AND PUBLIC BUILDING AREAS**

# A remarkably useful unit with dozens of applications

MODINE Cabinet Units meet the requirement for fast, positive and quiet distribution of heated or cooled air — where the expense and elaborateness of unit ventilators or air conditioners are not warranted.

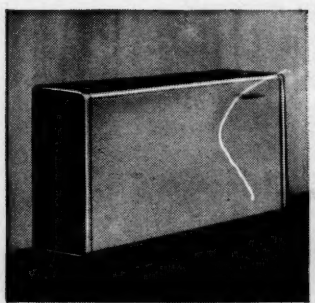
Models for heating with steam or hot water . . . cooling with chilled water. Cooling models may be used for *both chilled water cooling and hot water heating.*

Exceptionally attractive in appearance and versatile in application, Modine Cabinet Units offer many interesting possibilities for new buildings and remodeling jobs. Available in five sizes from 120 to 640 Edr.

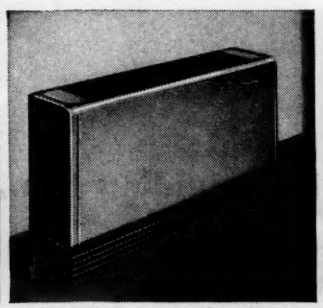
**GET FREE ILLUSTRATED BULLETIN 550 TODAY** and find out how you can profitably use Modine Cabinet Units. Call your Modine representative listed in the classified section of your phone book. Or write direct to Modine Manufacturing Company, 1511 DeKoven Ave., Racine, Wis.

**Modine**
**CABINET UNITS**
**FOR HEATING & COOLING**

C-1145

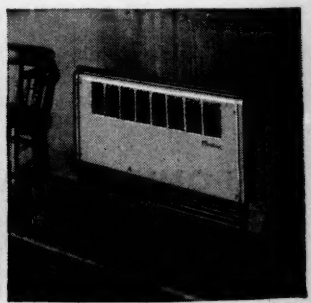


Type C — basic Modine Cabinet Unit for wall mounting where off-the-floor installation is desired.



Attractive louvered plenum base — with or without fresh air damper — makes Type C a floor mounted cabinet.

Type C with optional inlet grille for ceiling use — (heating only). Duct connectors also available.

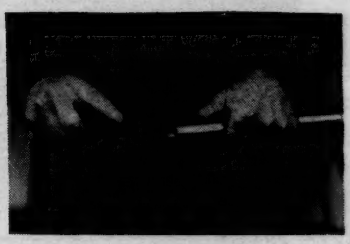


Type CR with face outlet grille and plenum base for recessed installation. This unit for heating only.

# It's simple to make a good flared joint connection

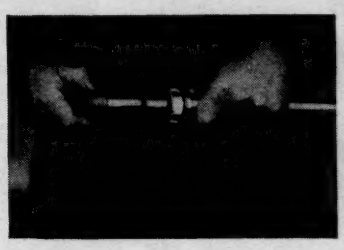
**1** Unroll the coil of Chase Soft Temper Copper Water Tube. Cut off needed length with hacksaw.

**2** With a file or a reamer, remove all of the burs and smooth the inside edge of the tube at the opening.



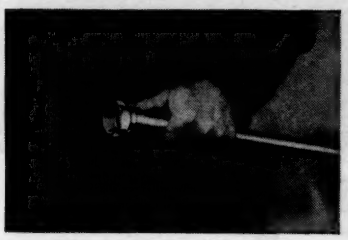
**3** File off the burs and smooth the outside edge. Filing and smoothing make a snug fit at the fitting.

**4** Slip the sleeve nut over the end of the tube. Be sure threads are toward the open end of tube.

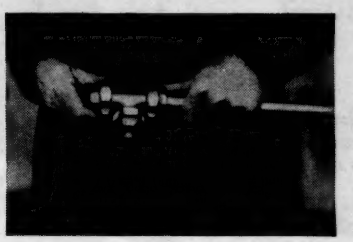


**5** Choose a flanging tool corresponding to the size of tube. Cover tool shank with oil and insert into tube.

**6** Hammer the end of the flanging tool until the edge of the tube fits into the undercut of the tool.



**7** After flanging, draw sleeve nut to end of tube. It is now ready to be threaded onto the fitting.



**8** Put a drop of oil on the inside surface of the flange. Insert fitting into the sleeve nut and tighten it well.

**9** Fit the next tube in the same way. Screw up the sleeve nut tightly so as to make a strong connection

**THE EASE** of making flared joints is only one of the many advantages of Chase Copper Water Tube.

**CHASE TUBE** is *soft tempered* . . . easy to bend around corners or form into U-bends. You'll appreciate this Chase feature in laying underground water lines and oil lines.

**CHASE COPPER WATER TUBE** is excellent for replacement work, too. It comes in long lengths up to 100 ft. that can be snaked between partitions and under floors, with a minimum of disturbance to existing construction.

**FREE** folders give details on making flared joints and solder-joint connections with Chase Copper Water Tube.

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

• *The Nation's Headquarters for Brass & Copper*

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Chase Brass & Copper Co., Dept. HV452
Waterbury 20, Conn.

*Please send me FREE Chase folders on Chase Copper Water Tube.*

Name_____

Position _____

Firm_____

Street_____

City_____ State_____

# trouble-free underground conduits

are assured with..

"Z"crete CAST IN PLACE **INSULATION**

**NO OTHER INSULATION FOR UNDERGROUND PIPING...**

***OFFERS ALL THESE ADVANTAGES***

**Extra efficiency**—Greater insulation thickness provides plus insulation value. Monolithic, contains no joints to leak heat.

**Added protection**—Cast-in-place construction eliminates voids and joints, assures restricted water movement around the pipe assembly.

**More Economical,** particularly on large-size piping and multiple conduits. Permanently efficient, lasts a lifetime.

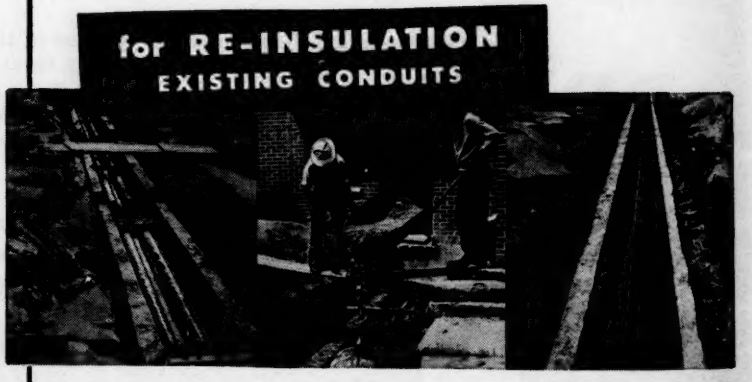
**More Adaptable**—Any size, arrangement and number of pipes can be included in the conduit.

**Readily Available**—Materials for "Z"-Crete construction are on hand in plants in key cities throughout the U.S., Canada and Alaska. No critical materials involved in the "Z"-Crete method.

**Permanent**—"Z"-Crete insulation will not disintegrate, deteriorate, crack or crumble. Verminproof, rodent-proof.

for *NEW* CONSTRUCTION

for RE-INSULATION EXISTING CONDUITS



CLEAN OUT THE OLD

POUR IN THE NEW

INSULATION TROUBLES ARE THROUGH

"Z"crete DIVISION

Licensed applicators in all principal cities.

**Z-Crete is a registered trademark of Zonolite Company*

**Write for design data and other information to Dept. HV-42**

**ZONOLITE COMPANY**

**135 S. La Salle St. • CEntral 6-5885 • Chicago 3, Ill.**

# 8-hour job now takes 4 hours

**At a western magnesium reduction plant something besides magnesium has just been reduced. The steam at the end of the 1½ mile long steam line wasn't so hot—and neither was the production record of the plant at that location.**

**Then 26 old-type steam traps were replaced with Yarway Impulse Traps. Now there is only a 15° temperature drop from the boilers to the end of the line. *Most important, the plant 1½ miles from the boilers is now able to do work in 4 hours that previously took 8 hours.***

**That's trap efficiency! It's evidence of the fact that Yarways are designed to send the most premium B.T.U.'s at top temperatures into your process or product. *They get equipment hotter, sooner . . . and keep it hot.***

**Other Yarway features—small size, one moving part, easy installation, low maintenance, low cost, stainless steel construction. Nearly 750,000 Yarways have already been installed. For your Yarways, see a nearby industrial distributor . . . 216 stock and sell Yarways.**

**YARNALL-WARING COMPANY, 104 Mermaid Ave., Philadelphia 18, Pa.**

**FREE TRAP SELECTOR**

**It's important to have the right trap in the right place. New 20-page selector tells quickly and easily which *is* the right Yarway trap for any application. Write for your free copy.**

## the steam trap

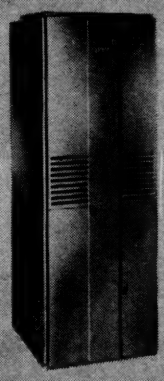
## designed with more production in mind

# "You save a lot more than space with this broom-closet furnace"

**says Hess Swallow,**

**Bryant, Detroit Branch Manager**

"Out of sight, out of mind" is by far the *safest* approach to concealed heating. Such equipment has to be *right*—or it's all wrong, and few can afford to have that happen. Making things *right* is an old Bryant custom, and it certainly has paid off in the way you've accepted our *Vertical Forced-Air* Furnace. It has paid off for *you*, too, in the way this compact, highly efficient gas furnace has performed—in thousands of single dwellings, more thousands of multiple-housing units, over the country. Completely automatic and occupying as little as two square feet of floor space in the smaller sizes, the Bryant Vertical Gas Furnace can help you cut construction costs while providing more living space for homemakers. Your Bryant Distributor will be glad to give you all the details and help you fit the Bryant Vertical into your plans. Or you may write Bryant Heater Division, Dept. 144, Affiliated Gas Equipment, Inc., 17825 St. Clair Avenue, Cleveland 10, Ohio.



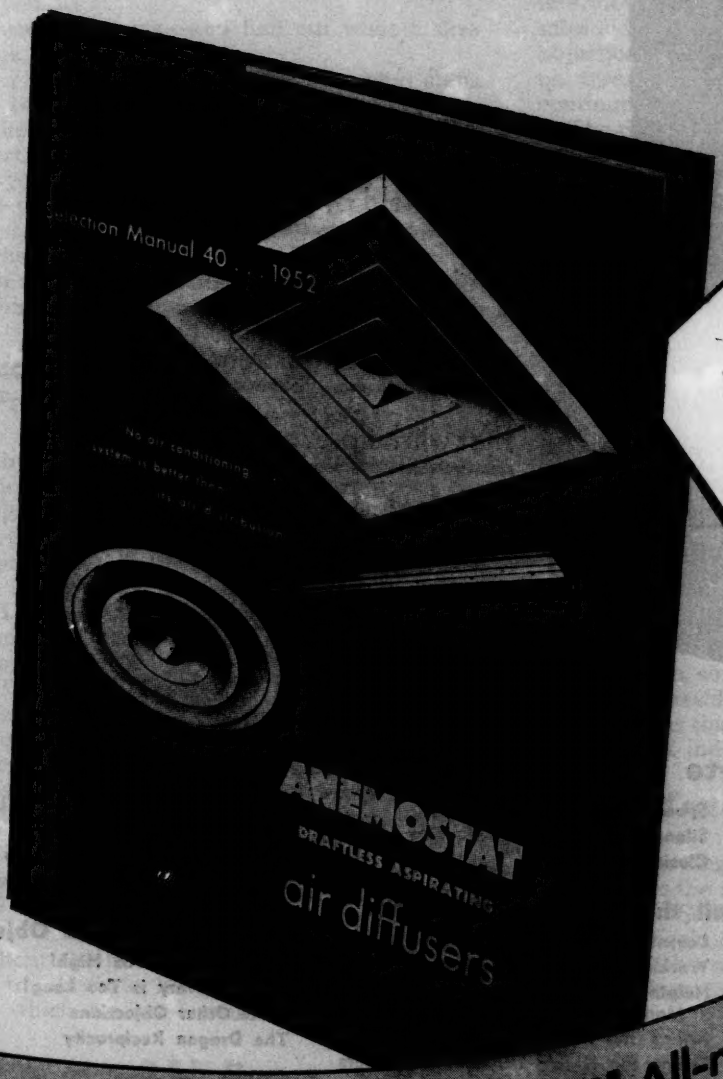
**Bryant Model 304**
**Winter Air Conditioner**

**Gas-fired, forced-air furnace. Six sizes, with inputs from 45,000 to 145,000 Btu per hour. Approved by A. G.A. for all gases. Features *Hevigage* Heat Exchanger and *Push-Button* Ignition (city gases only).**

# bryant *best buy*

**IN HEATING,**
**AIR CONDITIONING,**
**WATER HEATING**

# Now Ready for You!




**OF SPECIAL INTEREST!** All-new section on Anemostat High Pressure units for high pressure, high velocity systems.

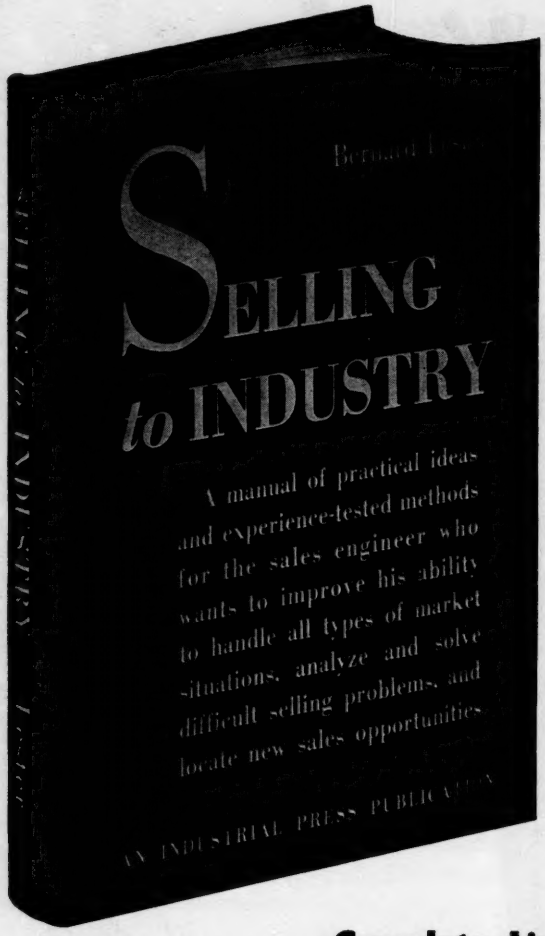
**ANEMOSTAT®**

**DRAFTLESS *Aspirating* AIR DIFFUSERS**

Anemostat Corporation of America
10 East 39th Street, New York 16, N.Y.
*Representatives in Principal Cities*

*"No Air Conditioning System Is Better Than Its Air Distribution"*

**The new 1952, 64-page Anemostat Selection Manual 40 gives you complete, up-to-the-minute information on Anemostat air diffusers. Ask your Anemostat representative for your copy, or write for it on your business letterhead today.**


SELLING
to INDUSTRY
A manual of practical ideas and experience-tested methods for the sales engineer who wants to improve his ability to handle all types of market situations, analyze and solve difficult selling problems, and locate new sales opportunities

# Be a Better

**An outstanding authority in the field of sales engineering gives practical ideas and suggestions that will help every industrial salesman to do a better job**

## Complete List of Subjects Covered

### Prospects are Our Market
- Knowing Our Market
- How to Find the Prospect
- The Cold-Nosed Hound
- Ideas Make Inquiries
- How the Salesman Can Create Inquiries

### Just How do Prospects Buy?
- The Fable of an Equipment Salesman
- Patterns Followed in Buying
- Buying Motives

### Sales Program Essentials
- Selling Expense is a Real Element of Cost
- "Giving" is Necessary before "Getting"
- Time is the Sales Engineer's Raw Material
- Knowing the Product We Sell
- Planning Each Sales Program

### Make the Sales Program Effective
- Selling Ourselves to People
- Time Each Move In Selling
- Sell the Human Values of Our Product
- Selling the Home Headquarters
- The Sales Engineer and His Manager

### Successful Sales Interviews
- Planning the Sales Interview
- The Approach to the Prospect
- Know What's on Our Prospect's Mind
- What Makes a Sales Interview Successful?
- Speech and Action in Selling
- Silence and the Sales Interview
- Closing the Sale

### Sell the Prospect's Employees
- Learning to Size up Our Man
- Working with Men in Customers' Plants
- Helping the Production Man Sell Management
- Selling the Purchasing Official
- Selling the Highly Technical Engineers
- Selling Top Management

### Be a Better Equipment Salesman
- The Successful Sales Engineer Follows Through
- Persistency is a Virtue—But!
- "Back Tracking" May be Expensive
- Are We Team Captains?
- When We Meet Trouble
- Entertaining Customers

### Getting Help from Others
- Make Other Equipment Salesmen Our Friends
- Bankers are Good People to Know
- Consulting Engineers and Contractors Can Help Us Sell

### Use All Our Sales Tools
- Visual Aids in Selling Equipment
- Effective Use of Visual Aids in Selling
- The Sales Engineer and Advertising
- Using Catalogs and Technical Literature
- Written Words—The Engineering Report
- Letters to Prospects Can Help Sell
- Proposals Should be Sales Tools

### Meet the Prospect's Objections
- Your Price is Too High!
- Your Delivery is Too Long!
- Some Other Objections
- The Dragon Reciprocity

### Follow Up the Customer's Decision
- After We Get the Order—What?
- When a New Equipment Project is Shelved
- Why Did I Lose that Order?

### Grow in Power and Sales Skill
- We Should Look at Ourselves
- Who's the Better Salesman?
- Have We a Good Yardstick?
- Develop Strategy in Selling
- Will They "Smile Back" at the End of the Year?

### When Orders Hang on Trees
- When All Signs Point to a Flood of Orders
- Hot Spots in a Seller's Market
- Persuasion in Boom Times
- Streamlining Our Time in a Boom Market
- Sell and Sell and Sell!

# Sales Engineer!

If you are engaged in selling equipment or technical products to industrial users, "Selling to Industry" will help you . . .

—size up your prospects—and find out what makes them tick.

—plan your campaigns—and see exactly what steps need to be taken.

—close more sales—and do it with a minimum of time and effort.

—analyze your mistakes—and use such experience to improve your selling ability.

—keep from sliding backwards—particularly in boom times when the going is easy.

—establish a solid basis of achievement—and lay the foundation for a successful sales engineering career.

## Specifically Devoted to Industrial Sales Problems

Writen by Bernard Lester, former sales executive, training director and consultant in the field of sales engineering, "Selling to Industry" specifically covers the problems encountered in selling industrial and technical products or services, and the solutions which have been found by experience to be most successful.

As Mr. Lester points out in his introduction: "Selling any prospect effectively does not follow a beaten path. Prospects and salesmen vary in temperament, habits and interests. Products sold differ, and new problems in their application and use continually crop up. But success in selling is not a haphazard affair. Proper preparation and orderly enthusiastic procedure are necessary. 'Selling to Industry' sets forth in a brief and realistic way those key points which have from experience been found to be most effective."

## Typical Subjects Covered

Throughout the book, the author uses brief "case histories" to illustrate his points, describes specific situations which he has encountered, and discusses methods of handling them. For example, he shows how to locate prospects . . . how to plan the sales interview to meet varying conditions . . . how to use sales aids effectively . . . how to overcome customers' objections . . . what should be done when orders "grow on trees" . . . how to follow up a sale to insure continued good will.

The complete table of contents at the left outlines the many selling activities that are covered. Each subject is treated in an easy-to-grasp form, and each point is developed concisely yet completely, so that ready-to-apply information will be found on every page.

## Handy Pocket Size

"Selling to Industry" is bound in handy pocket size (approximately 4½" x 7") so that the sales engineer can slip it into his pocket or brief case to be picked up and read whenever a spare moment presents itself. In addition, the sales manager will find it a valuable desk book. He will use it frequently as a source of material and an idea stimulator for sales training courses, for letters and bulletins, and for sales talks.

However favorable current conditions in your industry may be, you cannot afford to neglect the principles of good industrial salesmanship. "Selling to Industry" presents these basic principles in convenient form, so that they can be frequently reviewed and kept freshly in mind. It gives factual, result-getting ideas that can be effectively applied in selling all types of industrial (or technical) equipment.

## Order Your Copy Today!

Everyone engaged in industrial selling, from sales manager to the newest recruit on the staff, should own a copy of "Selling to Industry." If you wish to see how this book can help you, mail the coupon below, and it will be sent postpaid at once. You may have the privilege of five days' free examination if you prefer.

**255 Pages**
**4 1-2" x 7"**

**$3.50**

**Postpaid in U. S.**

Canadian or foreign postage, 40 cents

**ORDER FORM**

**Check Method of Payment Desired**

☐ Firm Purchase Order enclosed.

☐ $..... enclosed is check or money order in full payment. (Money will be refunded if you are not satisfied.)

☐ Send book postpaid. Payment will be made within five days if book is kept.

(Foreign orders must be accompanied by payment in full, including 40¢ postage.)

**The Industrial Press, 148 Lafayette St., New York 13, N. Y.**

Please send me ..... copies of "SELLING TO INDUSTRY" at $3.50 each.

Name .....

Company .....

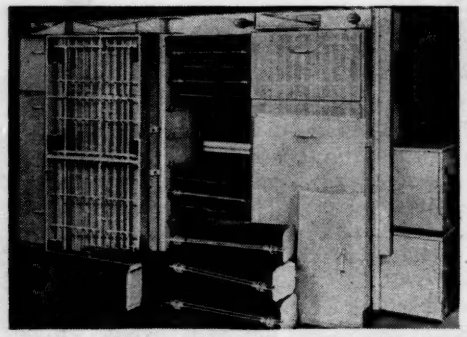
Street and No. .....

City ..... Zone ..... State .....

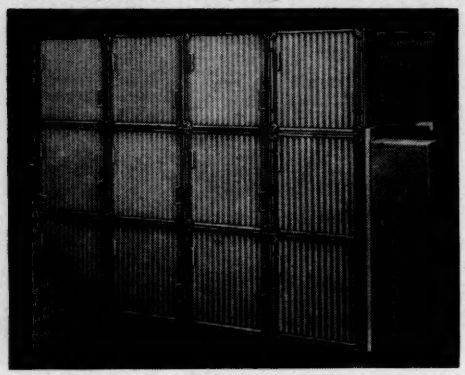
Home Address .....

City ..... Zone ..... State .....

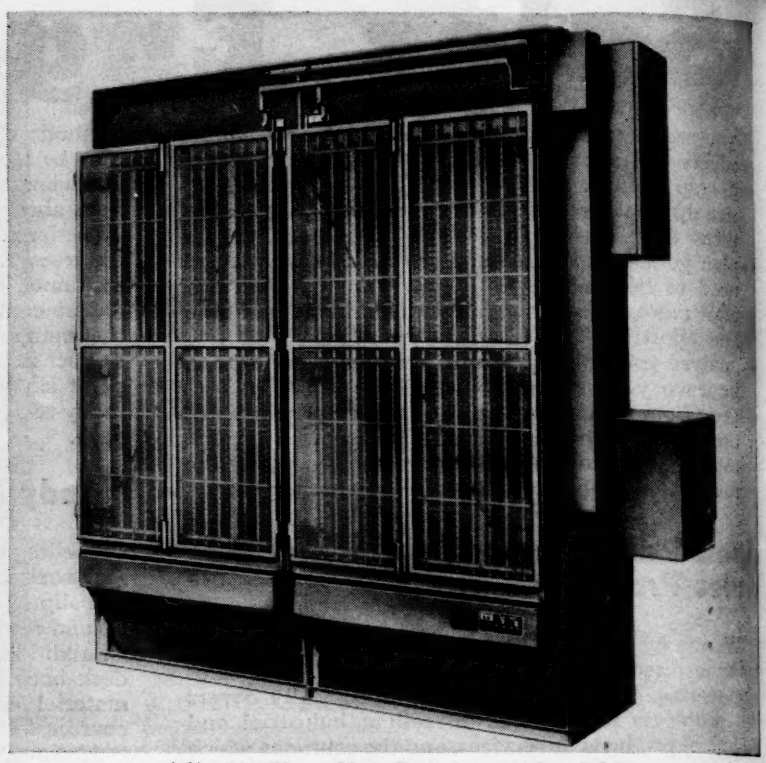
(Please fill in if you wish book sent to your home) H&V 4/52



*A No. 11-83 Electro-Cell Precipitator with hinged ionizer opened and a few plate cells removed.*



*A No. 4S-3 Electro-PL electronic air filter of 12,000 cfm capacity—in straight bank arrangement.*



*A No. 7-84 Electro-Matic Precipitator with end drive and power pack mounted on end plate of casing.*

# YOURS TO SELECT...
## from AAF's Three Types of Electronic Precipitators

***Electro-Matic . . . Electro-Cell . . . Electro-PL . . . each offers you individual characteristics and advantages . . . for cleaning air.***

It all depends on your *clean air* problem! It may be degree of air cleanliness, seasonal variations in requirements, method of maintenance, velocities, capacities, or perhaps initial filter cost. Regardless of the *engineering factors* . . . when you specify AAF Electronic Precipitators you may choose a type that fits the job to the closest tolerance.

American Air Filter offers three basic electronic types each having individual characteristics of performance, maintenance and method of precipitation. These are available in many sizes, capacities and arrangements to meet virtually any *clean air* specifications you may require:

**Electro-MATIC** The only electronic precipitator that has a self-cleaning feature. The collector plates are automatically cleaned and reoiled every 24 hours thus maintaining highest efficiency at all times over a wide range of particle sizes . . . from smoke to largest air-borne material. Available in any practical size or capacity.

**Electro-CELL** A washable plate-type electronic precipitator with removable cells. Its exclusive design with full-height hinged ionizers and sectional construction conserves space while providing highest air cleaning efficiency. Available in any practical size or capacity.

**Electro-PL** A unique dry-type electronic filter designed to provide intermediate air cleaning efficiency with maximum economy. Its charged Airmat media has twice the efficiency of uncharged dry-type filters. The Electro-PL is dual-purpose and may be operated as either a dry-type filter or with the electronic feature as seasonal conditions vary. Available in standard units for straight or "V" bank arrangements to meet any air volume requirements.

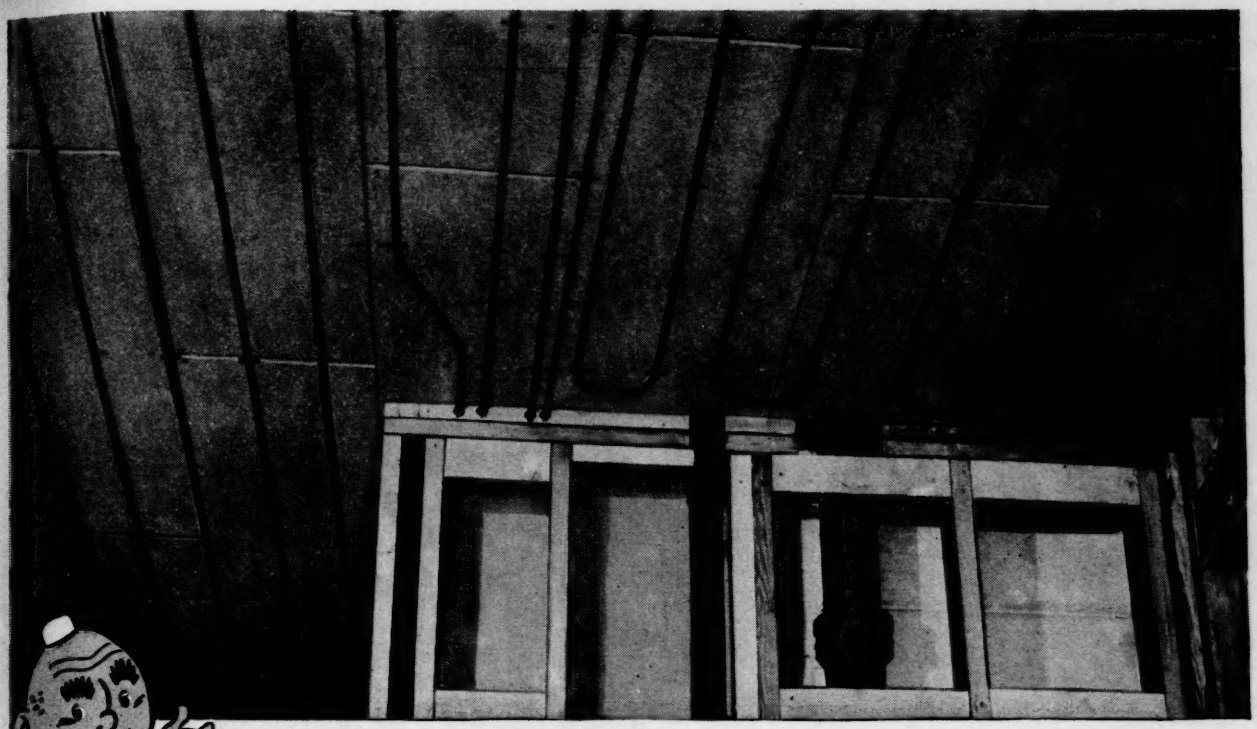
To solve your *clean air* problems electronically *call* your nearby AAF representative or write us today for Engineering Bulletin #510.

**PERFORMANCE CHARACTERISTICS OF AAF ELECTRONIC PRECIPITATORS**

| Type | Efficiency-Velocity Ratio | Resistance-Velocity Ratio |
|---|---|---|
| ELECTRO-MATIC automatic, self-cleaning, supplies super-clean air. | 85% at 500 fpm<br>90% at 400 fpm | .32" wg at 500 fpm<br>.20" wg at 400 fpm |
| ELECTRO-CELL washable, plate-type with removable cells. | 85% at 400 fpm<br>90% at 333 fpm | .29" wg at 400 fpm<br>.18" wg at 333 fpm |
| ELECTRO-PL low-cost, dry-type, dual-purpose. | 60% at 35 fpm | .12" wg at 35 fpm (Initial Resistance of 6 ply Type S Airmat) |

AAF

**American Air Filter**
COMPANY, INC.
294 Central Avenue, Louisville 8, Ky.
American Air Filter of Canada, Ltd., Montreal, P. Q. • Pacific Division Offices, San Francisco, California



# Your houses, regardless of style or cost, can offer Bundyweld ceiling radiant heating

***One of the most exciting, sales-producing features you can put into your houses. Today's finest heating — and tomorrow's; low in cost, easy to install.***

### Sales points for your houses

With Bundyweld ceiling radiant heating, your houses *feature* the most even, clean, economical, and convenient heating of all. It cuts housekeeping chores by hours; cuts fuel bills to pieces; postpones wall washing, redecorating, and cleaning of furnishings for years.

Here's heating that *truly* radiates — evenly, swiftly downward from the invisible ceiling system. Here's heating that feels natural, fresh, invigorating — as thousands of home owners will tell you.

### Easy, low-cost installation

With Bundyweld Tubing, a ceiling radiant heating system is a cinch to install at low cost. Standard 24' lengths of lightweight, ductile Bundyweld (one end expanded when specified) are easily handled; quickly bent, joined, and mounted onto the ceiling; then *easily* plastered over. Low-cost Bundyweld saves you time and money on the job, gives finest radiant heating performance, too. Send coupon below for *full* details.

## Bundyweld® Tubing

**DOUBLE-WALLED FROM A SINGLE STRIP**

© B.T.C.

**WHY BUNDYWELD IS BETTER TUBING**

Bundyweld starts as a single strip of copper-coated steel. Then it's . . . continuously rolled twice around laterally into a tube of uniform thickness, and passed through a furnace. Copper coating fuses with steel. Result . . . Bundyweld steel tubing, double-walled, and brazed through 360° of wall contact.

**Send for your copy of handsome 20-page brochure that gives you meaty facts on Bundyweld ceiling radiant heating. (Bundy also offers this brochure to future home buyers via full-page, 4-color ads in *Better Homes and Gardens* and *American Home*.)**

Bundy Tubing Company
Radiant Heating Division, Dept. HV 452
Detroit 14, Michigan

Yes! Rush me 20-page consumer brochure giving inside story of Bundyweld ceiling radiant heating ☐. I would also like a copy of Bundy trade brochure ☐.

Name_____

Position_____

Company_____

Address_____

City_____ Zone_____ State_____

# *"At National Cash Register we believe . . ."*

**STANLEY C. ALLYN**
President, National Cash Register Company

***"At National Cash Register we believe a thrifty employee is a better employee and a better citizen. By providing the Payroll Savings Plan for U. S. Defense Bonds we help our employees practice the thrift habit and build up a backlog of savings for their future security. By buying Bonds they become shareholders in their country."***

The employee who joins the Payroll Savings Plan becomes *a man with an objective*—a young fellow who realizes that the systematic purchase of Defense Bonds is a sure way to the down payment on a home . . . a father who wants to provide for Junior's college education . . . an older man, with an eye to retirement and personal security.

**The man with an objective is a better employee.** He knows that a day lost from work is just that much out of his take-home savings. He doesn't take chances—wants to stay off the accident list. He has a new realization that better work on his part will lead to advancement—and a larger monthly allotment for Defense Bonds.

**The man with an objective is a better citizen,** holds his head a little higher. He is buying a growing share in America . . . helping to combat inflation . . . making a real contribution to the defense effort.

These employee and *employer* benefits of the Payroll Savings Plan are reflected in the records of thousands of companies. Figures show that as employee participation in a Payroll Savings Plan grows to 60%, 70% or higher, absenteeism decreases, the "Lost Time Accidents" curve goes down and production goes up.

If 60% or more of your employees are not Men With Objectives, do something about it. Phone, wire or write to Savings Bond Division, U.S. Treasury Department, Suite 700, Washington Building, Washington, D. C., and your State Director, Treasury Department, will show you how to install a Payroll Savings Plan, or how to build an existing Plan.

During 1951, over 1,500,000 employed men and women joined the Payroll Savings Plan.

*The U.S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and*

# nyb FANS

## SKILLFULLY ENGINEERED ACCURATELY RATED FEATURE HEAVY WELDED STEEL CONSTRUCTION

***Type ME Centrifugal Fans***

Two types of fan wheels. Housing dimensions remain the same but performance characteristics differ.

Slow speed wheels offered from 7½ to 73 inch. Capacities up to 70,000 CFM.

Quiet operating, medium speed (PL) wheels with non-overloading horsepower characteristics for heating, ventilating and air conditioning or industrial applications. Wheel diameters from 18 inch to 73 inch, with any speed or discharge required. Capacities up to 123,000 CFM. Class I, II, III or IV construction.

All-welded housings featured as standard construction for simplicity, extra strength and rigidity —dust tight and leak proof. Bolted (knock-down) type available in Class I and Class II. Split housing can be furnished as extra if required.

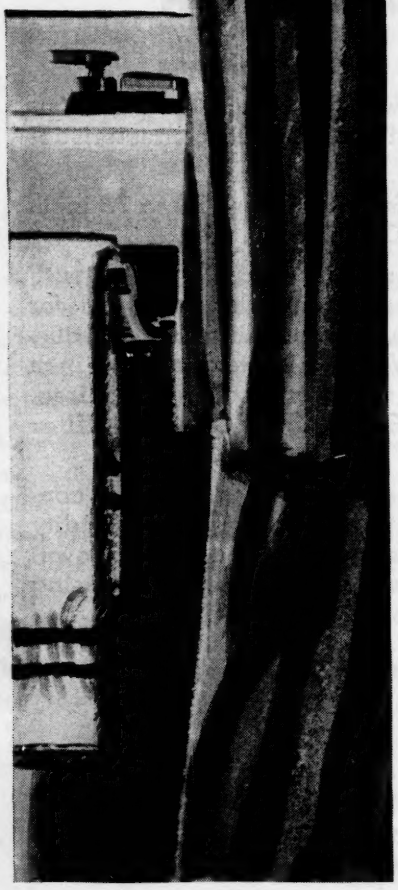
*Write for Bulletin 493*

nyb

**THE NEW YORK BLOWER COMPANY**

SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA



# GOOD REMEDY for business ailments

Many of the big pharmaceutical houses use Worthington air conditioning and refrigeration machinery to control chemical reactions, inhibit bacteria, prevent deterioration.

And many a corner drug store keeps up "hot weather" business by using Worthington air conditioning to make the premises inviting to customers.

No other manufacturer makes *so complete* a line. A Worthington system is all Worthington-*made*—not just Worthington-assembled—assuring you of perfectly balanced operation and unit responsibility.

Worthington Pump and Machinery Corporation, Air Conditioning and Refrigeration Div., Harrison, N. J.

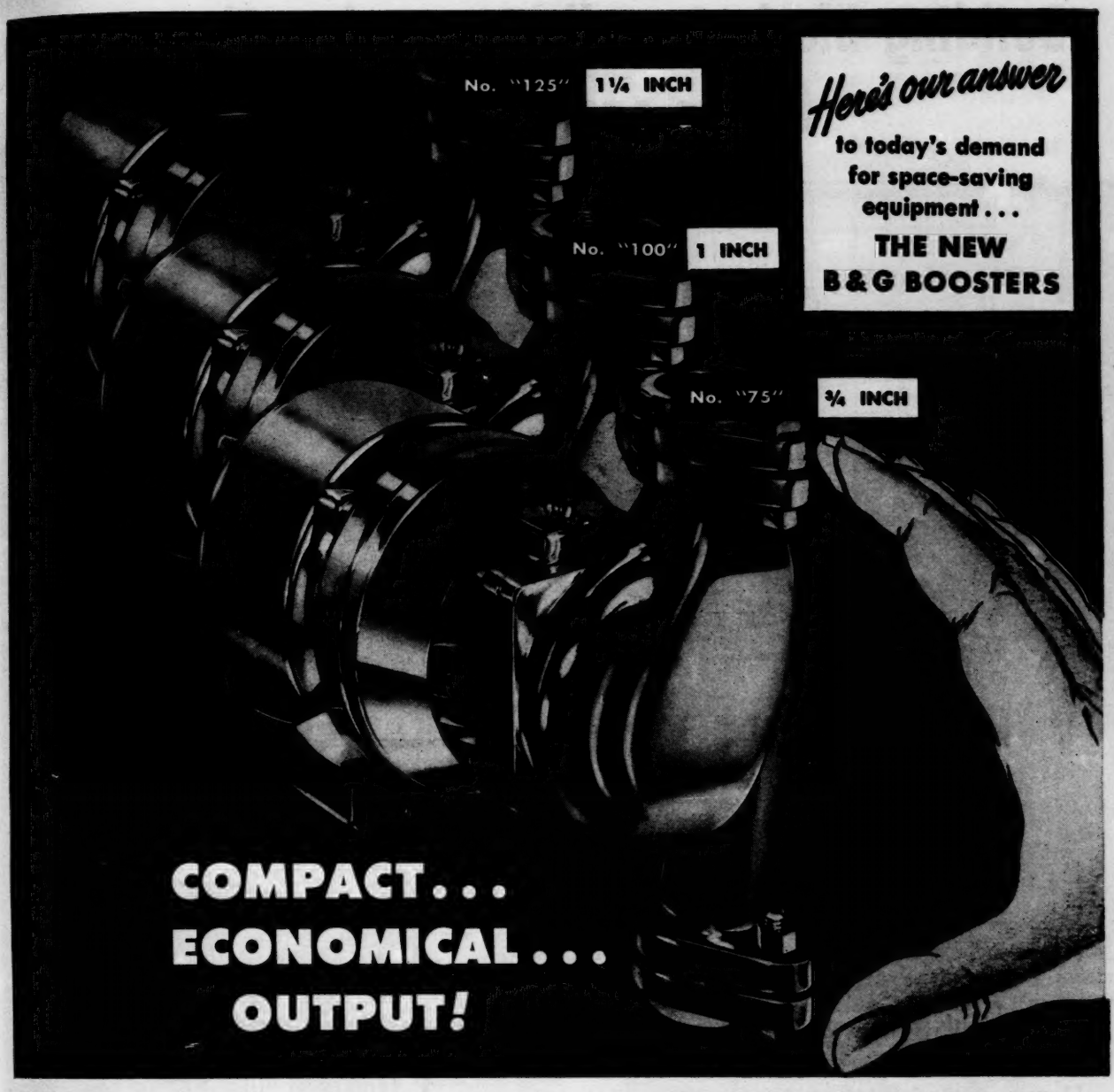
America's Leaders... in Many Businesses... Select

**WORTHINGTON**

A.2.8

**AIR CONDITIONING AND REFRIGERATION**

**The Most Complete Line... Always the Correct Recommendation**




## All the famous B & G Booster features in smaller, lighter units

**Famous builder of small homes says—** "These are the pumps for us—they are ideally suited to our small home designs. We never could see the idea of a large, overpowered pump to do the job required by a few hundred feet of radiation. Congratulations on the way you have answered a growing problem."

Today's trend to smaller homes makes it imperative that operating equipment be made as small as possible. This new series of B & G Boosters was designed specifically to answer your requests for more compact, space-saving units.

The small 1/12 H.P. motor, designed and built in the B & G plant, consumes less current . . . keeps operating costs at a minimum. Ideal in every respect for residential installations or for zoned jobs where individual circuits are comparatively short in length.

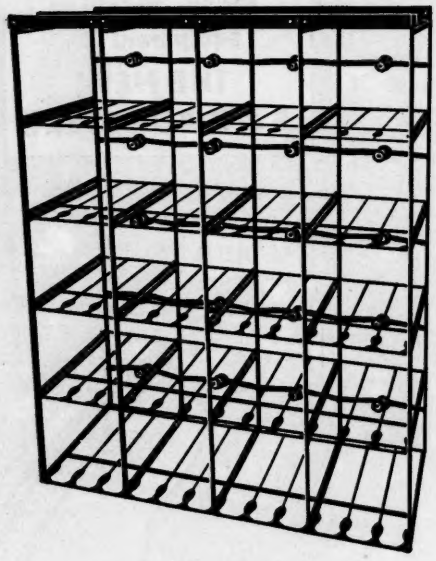
Important, too, is the conservation of critical metals. The smaller sizes of B & G "75"—"100" and "125" Boosters permit more units to be produced from any given allotment.

Nearly a quarter of a million of these new-design Boosters are installed at the present time. Their performance has proved the soundness of B & G engineering —you can install "75", "100" and "125" Boosters with complete confidence in their efficiency and dependability.

**BELL & GOSSETT**
COMPANY
Dept. CL-4, Morton Grove, Illinois
*Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada*

*Reg. U. S. Pat. Off.

# "Building block" installation makes Electromaze filters easiest to install



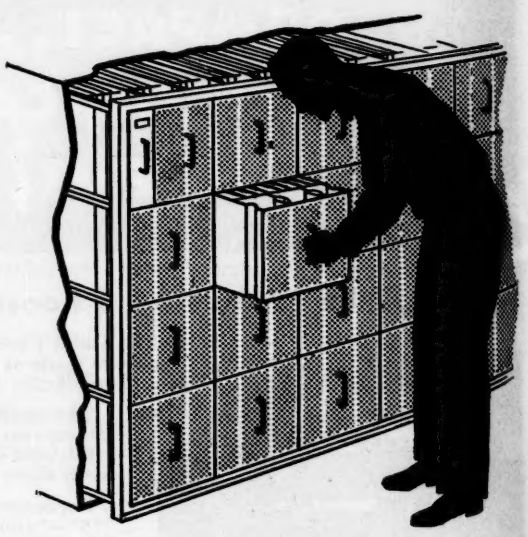
Contractors report that Electromaze precipitators require 50% less time and effort to install than other electronic filter systems.

Electromaze filter banks can be erected faster and more economically because the cellular steel holding frames come in prefabricated sections. All you have to do is bolt them together to form banks built like a skyscraper. Light, easy-to-handle Electromaze Uni-Cells slide into the holding frames to complete the bank. Cells come in three sizes—can be combined to meet almost any space or capacity requirement.

# "Desk drawer" design makes Electromaze filters easiest to clean

Electromaze cells slide in and out of frames like desk drawers, can be instantly removed for inspection, servicing or replacement. They can be cleaned in place with a hose under ordinary city water pressure. Should manual cleaning become necessary —as it may in all types of electrostatic filters—removal is quick and easy, electrical contact automatically made or broken.

Electromaze precipitators are supplying super-clean air for hundreds of offices, stores, hospitals, factories, bowling alleys and other commercial and industrial applications. Get expert help in solving your air filtering problem from your nearby Air-Maze representative, or write Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.



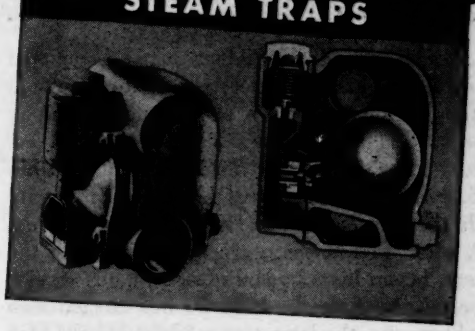
*The biggest names in diesels are protected by Air-Maze filters*

AIR FILTERS
SILENCERS
SPARK ARRESTERS

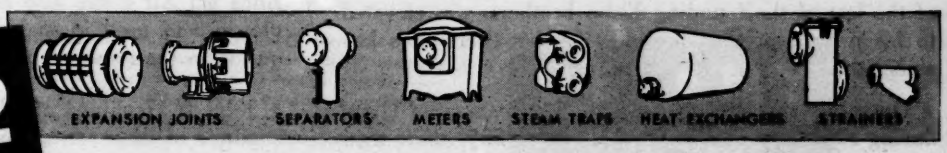
**AIR-MAZE**
THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

# ADSCO STORAGE HEATERS



You get more than you ask for, when you buy an ADSCO storage heater . . . They are built to ASME code, whether inspection and stamping are required or not . . . Water spreader over cold-water inlet . . . Heavy rings in reinforced manhole give good gasket surfaces . . . Flange-quality steel used throughout . . . Tubes bent smooth and round . . . ADSCO heaters provide a constant, dependable source of domestic hot water and are especially suited for handling peak demands. Write for Bulletin 35-75C.




ADSCO
75 YEARS OF LEADERSHIP

**AMERICAN DISTRICT STEAM COMPANY, INC.**
**NORTH TONAWANDA, NEW YORK**

# BRIEFLY STATED

• Axeman-Anderson Co. of Williamsport, Pa., has bought out the Anthratube boiler burner division of Bethlehem Foundry & Machine Co., Bethlehem, Pa. Manufacture of the Bethlehem unit will be discontinued, but parts and service for those units now in use will be maintained. No part of the Bethlehem unit will be incorporated in the design and manufacture of the Axeman-Anderson unit.

• Stewart E. Lauer, president of York Corporation, announced today that his firm has received an order valued at approximately $435,000 to air condition two buildings of the Consolidated Vultee Aircraft Corporation at Pomona, Calif., which will be used for the manufacture of guided missiles for the U. S. Navy. According to Mr. Lauer, the air conditioning systems, totalling about 4,700 horsepower, will be used to dissipate the heat load of the machinery engaged in the manufacture of guided missiles so that temperatures from 75 to 80F can be maintained. No further details were announced.

• Proved recoverable natural gas reserves on December 31, 1951, totaled 193.8 trillion cubic feet, an increase of 8.2 trillion feet over estimated reserves of 185.6 trillion cubic feet a year earlier, it was announced today in a joint report of the Committee on Reserves of the American Gas Association and the American Petroleum Institute. These reserves climbed to a new record high level, scoring the second highest increase made since these estimates were started and were registered over an all-time high production of approximately 8.0 trillion cubic feet of natural gas used during 1951. In 1950 the production of natural gas was 6.89 trillion cubic feet.

• On February 25th C. H. Wheeler Manufacturing Co. broke ground for a $600,000 addition to their plant in Philadelphia. The new building will be equipped with 30 ton cranes and will be 300 feet long. A new centrifugal pump test laboratory is being provided with a 400,000 gallon pit with venturis, weirs and dynamometers, for testing pumps up to 110,000 gpm.

• George H. Miehls, president of Albert Kahn Associated Architects and Engineers, was awarded honorary membership in the Michigan Society of Architects, Friday evening, March 7, at the society's 38th annual convention in Detroit. Mr. Miehls was born on a small Ohio farm in 1895, was graduated from Ohio State University in 1917 with the degree of B.S. in Civil Engineering, and in 1919, after 17 months overseas service with the 23rd Engineers, began his 32 years of continuous service with the Albert Kahn firm. In 1943 he was elected vice president, eighteen months later was made executive vice president and in November 1945, following the passing of the last of the founding Kahn brothers, was elevated to his present post as president by his twenty-five key associates.

• Operating revenues of Texas Gas Transmission Corp. during 1951 amounted to $39,511,000 or 28% more than 1950 revenues. In its annual report to stockholders, the company announced that net income for the 2600-mile natural gas pipe line system totalled $4,344,000. This was the same as in 1950.

• Morris E. Leeds, founder and chairman of the board of Leeds & Northrup Co., makers of electrical instruments, automatic controls and furnaces, died Friday night Feb. 8 at Lake Wales, Fla. He was 82, and had been ill for several weeks.

• Joseph A. Grazier has been elected executive vice president of American Radiator & Standard Sanitary Corp. At the same time, Mr. Grazier was named to the firm's board of directors and its executive committee. He succeeds the late J. Phillips Cosgrove in all three positions. Mr. Cosgrove died last December. Prior to his election to the new post, Mr. Grazier was serving as the corporation's vice president and secretary.

• The second National Air Pollution Symposium will be held May 5 and 6 at the Huntington Hotel, Pasadena. Under the sponsorship of Stanford Research Institute, in cooperation with California Institute of Technology, the University of California at Los Angeles, and the University of Southern California, sessions will follow the general pattern of the successful first symposium held under the same auspices in 1949.

• Theodore W. Rundell, formerly chief refrigeration engineer for the Philco Corp., has been elected vice president in charge of engineering for Servel, Inc. Dr. William R. Hainsworth, who has been vice president in charge of engineering, has been named staff consulting engineer to direct the company's long-range engineering program in all fields. He will continue as a vice president of Servel.

• The appointment of Harry J. Wines as sales promotion manager for the Bryant Heater Division of Affiliated Gas Equipment, Inc., has been announced. Mr. Wines comes to Bryant from General Electric where he managed distribution sales of their cooling and heating products.

• Worthington Pump and Machinery Corp. has elected C. K. Hood, formerly manager of the corporation's New York district sales office, to a vice presidency. He will be responsible for the direction of the activities of the public works, steam power, deaerating, water treating, and steam turbine divisions and will report to T. Cruthers, vice president. Mr. Hood, a graduate of Iowa State College, started his career with Worthington in 1918 and has been manager of the New York district sales office since 1930.

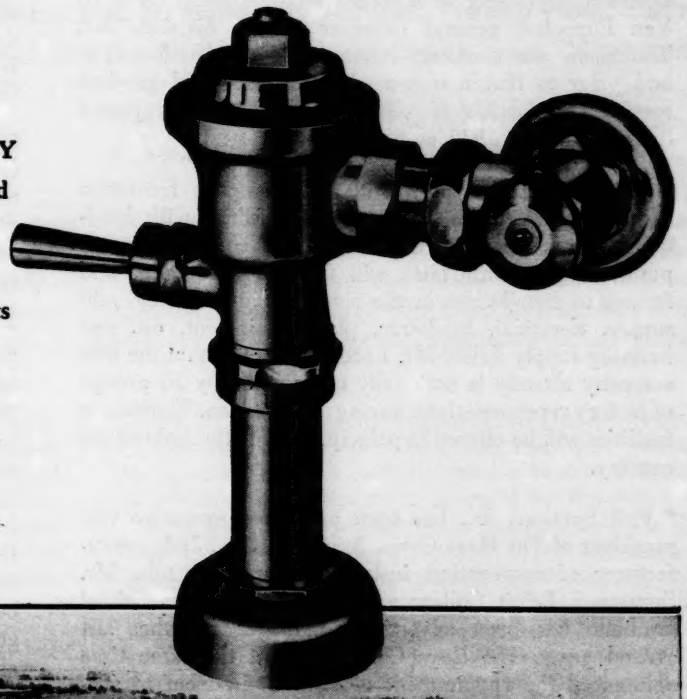
• Air Materiel Command, by reclaiming silica gel, recovers a six-month supply for 55 percent of the cost of same amount of new silica gel. About 4,900,000 pounds recovered yearly saves about $698,000. By recovering silica gel Air Force also saves 1,000,000 pounds of sulphuric acid used in making new silica gel but not required in the recovery process.

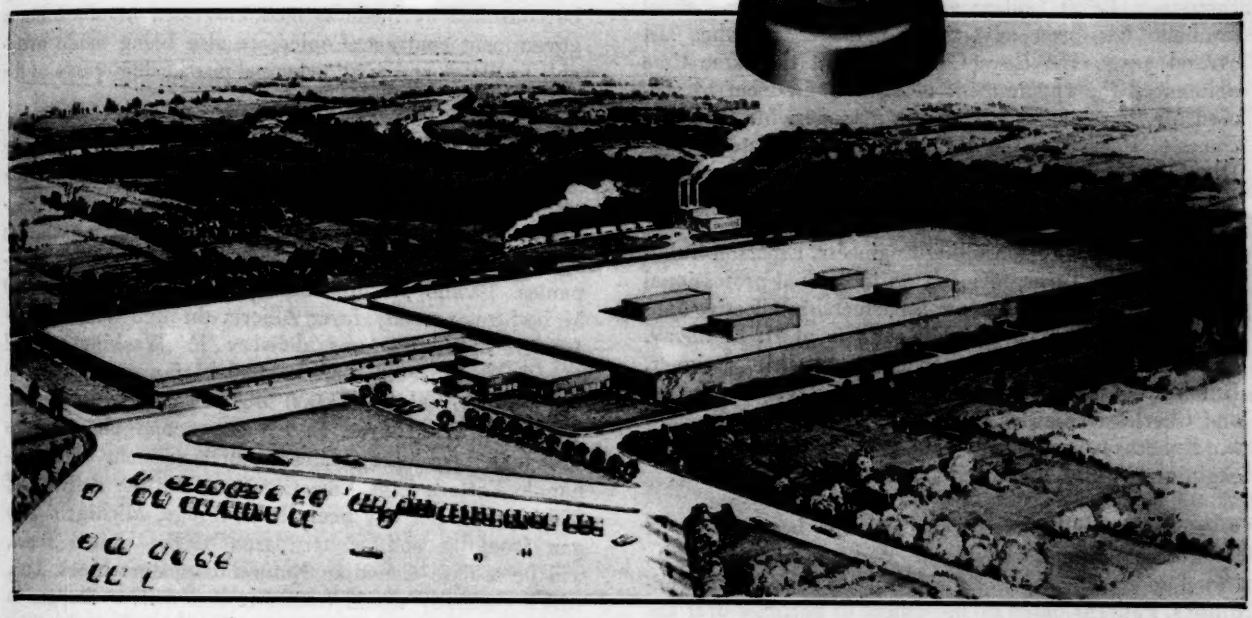
• John H. Jennings of Chicago has been named chief engineer of the room air conditioner division of Servel, Inc. For the past seven years Mr. Jennings has been chief engineer of the Mitchell Manufacturing Co., of Chicago, manufacturers of room air conditioners.

(*Briefly Stated continued on page* 80)

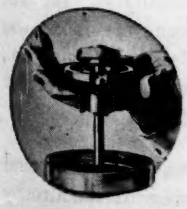
# *And in Clemson* – A FUTURE OF FAULTLESS SERVICE

Largest of its kind in the world—that describes this gigantic new Utica-Mohawk cotton mill, equipped throughout with DELANY FLUSH VALVES, as specified by the architects and engineers. Combining 14 acres of plant under a single roof, fine quality goods will be produced in uninterrupted flow from bale cotton to finished sheets and pillow cases. Equally uninterrupted will be the flawless operation of the COYNE & DELANY diaphragm type FLUSH VALVES and VACUUM BREAKERS—unmatched in design and virtually maintenance free.





**UTICA & MOHAWK COTTON MILLS**
*Division of J. P. Stevens & Co., Inc.*
*Clemson, South Carolina*
**LOCKWOOD GREENE ENGINEERS, INC.**
*architects & engineers*
**DANIEL CONSTRUCTION CO.**
*contractor*
**STEWART SUPPLY CO.**
*wholesale distributor*



*For those who have lived with COYNE & DELANY there is no other valve. Shown at left is a deciding factor—the interior working assembly of a DELANY valve Only six working parts comprise this assembly—less than any other valve offers today. Removing the valve cover immediately identifies any source of difficulty, and replacements, if necessary, are accomplished inexpensively, instantaneously—and infrequently.*

**DELANY** *Flush* **VALVES**

**COYNE & DELANY CO. • 834 KENT AVE. • BROOKLYN, NEW YORK**

*Since 1879*

(*Briefly Stated continued from page 78*)

• L. E. Thompson has been appointed manager of marketing of the General Electric Co.'s Air Conditioning Division, according to a recent announcement by F. J. Van Poppelen, general manager of the division. Mr. Thompson was formerly manager of distribution sales and prior to that manager of parts sales and product service for the Air Conditioning Division. He joined the company in 1935 at Schenectady.

• G. E. Leadbetter, president, announces the formation of the Manufacturers Corporation of Ohio, with headquarters in Mansfield, Ohio. The new company, incorporated under Ohio laws, will furnish plastic pipe and fittings to distributors in the plumbing and heating, mill supply, electrical, hardware, plant equipment, oil, and building supply fields. Mr. Leadbetter states that the new company already is nationally represented by 16 groups of factory representatives, having 51 field men. Warehouse facilities will be offered at principal points throughout the country.

• Phil Sprague, Jr., has been appointed executive vice president of The Hays Corp., Michigan City, Ind., manufacturer of combustion instruments and controls. Mr. Sprague a Beloit College and Harvard Business School graduate has been advertising manager for the past several years. The Hays Corporation at the same time announced the appointment of Paul B. LeBoeuf to succeed Mr. Sprague as advertising manager. Mr. LeBoeuf comes to Hays from the A. O. Smith Corp. Water Heater Division, Kankakee, Illinois where he was in charge of advertising and sales promotion.

• H. E. Bovay, Jr., Consulting Engineers, Esperson Building, Houston, Texas, formerly an individual professional engineering practice, became a partnership effective January 1, 1952. The partnership consists of H. E. Bovay, Jr.; Bennett W. Burns, formerly assistant chief designer, Humble Oil and Refining Company, Baytown, Texas; and Charles A. Lawler, J. Wayne Holland and Richard B. Robertson, previously chief engineer and senior engineers with H. E. Bovay, Jr., Consulting Engineers.

• A new theory of weather patterns has been developed by a researcher at the Naval Medical Research Lab., New London, Conn., accounting for varied climatic conditions. Patterns based on movement of particles over the earth show a warm belt, six temperate triangles—three in each hemisphere, and six cold sectors, three radiating from each pole. Hypothetical patterns checked with known weather data show remarkable agreement. General acceptance of this theory may have far-reaching effects on long-range weather forecasting.

• Richard M. Burbank has been named as assistant sales manager, Unit Ventilator Division of the Herman Nelson Division, American Air Filter Co., Inc., Moline, Ill. Mr. Burbank was formerly manager of the company's Boston branch office. Other announcements named Frank T. Carroll, Jr. and Harold F. Meyer as regional product application engineers for the Merchandise Products Division. Mr. Carroll will serve the east and west coast offices of the company, while Mr. Meyer services Herman Nelson offices in the middlewest and south.

• On February 19, at the twenty-sixth annual meeting of the Industrial Unit Heater Association, officers elected for the ensuing year were G. A. Mathis, president; J. C. Patterson, vice president; and L. O. Monroe, secretary-treasurer. Mr. Mathis is vice president in charge of production of The New York Blower Co. and Mr. Patterson is sales manager of the Industrial Heating Department, Carrier Corp.

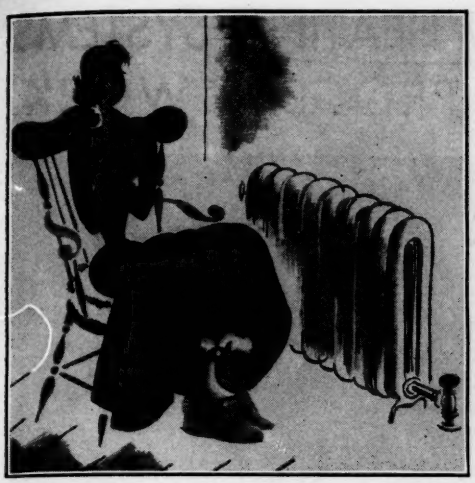
• The Fresh'nd-Aire Co of Chicago, a division of Cory Corp. and maker of domestic and commercial air treatment equipment, has announced the appointment of Hayden Kelly as advertising manager. Mr. Kelly was formerly associated with Hotpoint, Inc. of Chicago in their advertising division.

• Secretary of Commerce Charles Sawyer has announced the issuance by the Department of Commerce of a revised edition of the Government Procurement Manual which the Secretary described as the only source of information in the federal government covering the procurement activities of all major military and civilian agencies. The Manual lists 5,000 items and classes of items for which federal agencies are in the market. It is being placed in Department of Commerce Field Offices throughout the country and in local chambers of commerce where it can be consulted by business men interested in obtaining a government contract. Copies are also being made available to SDPA and to all principal purchasing offices of the military and civilian agencies.

• The Pacific Northwest Pipeline Corporation recently filed an application with the Federal Power Commission setting forth a completely different proposal than heretofore offered. It now contemplates a reciprocal exchange agreement between United States and Canadian companies. Pacific Northwest proposes to import 250,000 Mcf of gas per day from Alberta through a subsidiary for transportation and delivery in Washington and Oregon to the extent of 225,000 Mcf per day, and to export the remaining 25,000 Mcf per day for use in the vicinity of Vancouver, B. C. The second phase of the exchange agreement relates to an agreement with Panhandle Eastern Pipe Line Company for the delivery of 225,000 Mcf per day near River Rouge, Michigan. This gas, from the southwestern area of the United States, will be sold to Canadian Natural Gas Pipe Lines, Ltd., which company would transport and deliver the gas to market areas in Ontario and Quebec, including the cities of Toronto and Montreal. The Commission has scheduled hearings on this application to commence April 8 in Washington.

• Alfred L. Agne has been appointed advertising manager of Eureka Williams Corp., of Bloomington, Ill. The position is a newly-created one. Mr. Agne previously was advertising manager for Brunswick-Balke-Collender Co., Chicago, and a division sales promotion manager for Sears, Roebuck & Co., also in Chicago.

• The resignation of V. C. Havens as assistant general sales manager in charge of advertising of the Crosley Division of Avco Manufacturing Corp., has been announced. Mr. Havens came to Crosley from Consolidated Vultee Aircraft Corp. in November, 1948.



# COLD FEET...

**Dampness, Tremendous Heat Loss, Peeling Paint, Timber Rot, are the Products of Usual Crawl Space Construction**

***Nature's Law: Heat flows to cold in any direction by Radiation and Conduction.***

**So warm walls, ceilings, furniture, people, even dust particles, transmit *downwards* invisible energy rays through the air to a cold floor where they are absorbed, turned into heat, and conducted down. Also, heat flows *down* by direct conduction through solids, wherever walls, furniture and people touch the colder floor.**

How to prevent condensation and timber rot, conserve heat and create foot comfort, are explained by the National Housing Agency. Its "Technical Bulletin No. 38" reports numerous tests in which the National Bureau of Standards subjected multiple aluminum surfaces in crawl spaces to dampness from below, deliberate fogging, and tremendous temperature drops. To quote some of the findings:

### DEWPOINT NEVER REACHED

"The temperature of these surfaces was observed to be above the dew point of the contacting air under all test conditions."

"With average outside air temperatures between 30.9 and 32.2 degrees F., the temperatures of the upper surface of the insulation remained above the dew point of the air to which it was exposed by 12.5 to 15.7 degrees F.," with only 2 layers having 4 aluminum surfaces, forming 3 reflective spaces.

"When the outside temperature dropped from 56.3°F. to 31.4°F. in six hours, the insulation temperatures remained above the dew point by 14.6 to 10.3°F. When the ambient temperature was dropped from 39.2°F. to 9.2°F. in 24 hours, the insulation temperatures remained above the dew point by 12.9 to 5.8°F.," with only one layer of insulation, two reflective surfaces and spaces.

### CONDENSATION CANNOT OCCUR

"As a further indication of lack of condensation, the upper surface of the upper layer of insulation was deliberately fogged during several of the tests. Each time the surface of the insulation was so fogged, the condensed moisture disappeared within 5 to 10 minutes."

"The results indicate that condensation would not occur between the floor and the insulation or between the two layers of insulation during any probable winter conditions."

"Reflective insulation produces a marked rise in the temperatures of the floor surface."

### ORDINARY INSULATIONS SPILL OUT

Vapor flows from areas of greater density to those of lesser. The lower its temperature, the less vapor can air retain in suspension.

Ordinary insulations, including asphalt paper covered ones (asphalt is not impervious to vapor, only to moisture), get soaking wet in crawl spaces, because of condensation on the fibres from ambient vapor, and vapor flow from the earth below and the building above. So they tear at the staples and elsewhere because of wetness and added weight, and spill their contents to the earth, unless a costly support is built underneath, in which case timber rot is fostered by the wet mass.

Multiple accordion aluminum sheets weigh less than 1 oz. per sq. ft., are impervious to vapor, are non-condensation-forming, do not absorb nor retain any moisture, need only staples for support. They bar heat flow by RADIATION with their 3% absorptive and 3% emissive surfaces. Practically no heat flows by CONDUCTION through their multiple air spaces for air is a poor conductor. There is no CONVECTION heat flow downwards.

### NON-CONDENSATION FORMING INSULATION

One commercial form of multiple accordion aluminum, Infra Insulation Type 6, is pre-fabricated with three sheets of tough aluminum and two separating fibres to automatically form six reflective spaces, six fully reflective surfaces, as it is stapled in place, simply and speedily. Infra Type 4 provides 4 reflective spaces. For shallow structural spaces (less than 2") especially under floors, Type 4 Jr. is suggested.

For a more detailed discussion of the principles of heat and vapor flow and their practical application to the prevention of heat loss, discomfort and destructive condensation, consult "Technical Bulletin No. 38" and Alexander Schwartz's "Simplified Physics of Vapor and Thermal Insulation." Copies of either or both sent FREE.

**INFRA THERMAL FACTORS, DOWNHEAT**

**Type 6 C.044 R22.72 = 9" Dry rockwool**
**Type 4 C.065 R15.38 = 6" Dry rockwool**
**Type 4 Jr.* C.097 R10.30 = 4⅛" Dry rockwool**
***In 1" space.**

***INFRA INSULATION, INC.***

***525 Broadway, New York, N.Y.—WORTH 4-2241***

INFRA INSULATION, INC., 525 Broadway, N. Y. C. Dept. V-4

☐ Please send FREE "Technical Bulletin No. 38." ☐ Send FREE "Simplified Physics of Vapor and Thermal Insulation," new revised edition. ☐ Send Prices of Infra Insulations. ☐ Send Sample.

Name_____

Firm_____

Address_____

# MAXIMUM EFFICIENCY FOR STEAM HEATING SYSTEMS ON HEATING, DRYING AND PROCESS WORK.

**JENNINGS CONDENSATION PUMPS**

Designed for steam systems on heating, drying, or process work, these pumps offer the most reliable and efficient means of returning hot condensate to boiler or hot well. In many cases these pumps will save costly installation of boilers in a pit to provide gravity flow of returns from basement radiators and heating devices.

The Jennings Condensation Pumps are sturdy and compact in construction, and combine receiving tank, pump and driving motor in a single assembly. Pumps are bronze fitted throughout, with tobin bronze shaft. The pumping impeller is of special design, made possible by our wide experience with return line heating pumps, and is especially adapted for handling hot water with the greatest possible efficiency.

Full automatic control is furnished by means of a ball float and float switch mechanism mounted on the receiving tank. All wiring is made up at the factory, and it is necessary only to connect the pump to the system and hook up the leads. Complete information regarding these economical pumps sent promptly on request.

## THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

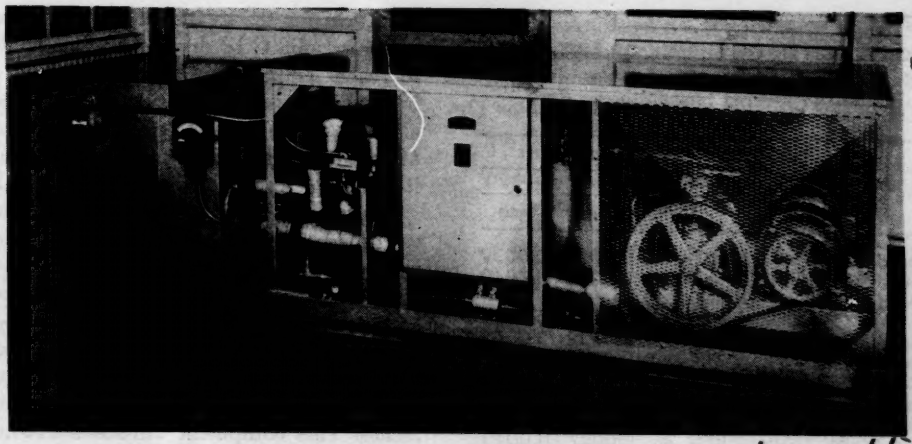


Fig. 1.

# Metal Processing at Subzero Temperatures

G. B. OLSON and H. T. GREGG, JR.

Metallurgists, Construction Materials Division, General Electric Co.

**Commercial equipment which is now available for producing temperatures as low as —200F, has made possible an increased use of subzero temperatures for processing metals. Data are presented on the various applications of low temperature in this field.**

USE of subzero temperatures for treating metals is becoming more and more prevalent. In fact, temperatures in the order of —150 to —200F can be obtained without too much difficulty for metal processing. Processes in which subzero temperatures are used at present include the following:

(1) Stabilization of precision gages and parts to eliminate size change.
(2) Subzero assembling processes.
(3) Control of the age-hardening of aluminum alloys.
(4) Making of mercury patterns.
(5) Subzero air cooling of metal cutting tools.
(6) Treatment of low-melting alloys for short run forming dies.
(7) A supplementary treatment in hardening steel.

Early work done on low-temperature treatment of metals was confined for the most part to a study of the change in properties of different metals at low temperatures. Subzero temperatures for these studies were obtained from solid $CO_2$ or liquified gases such as liquid oxygen or liquid air. One of the first accounts of this work, reported in 1889 by J. Hopkinson before the Royal Society of London, described his experiments performed in 1885 on nickel steel, containing 25% nickel and about 74% iron. This material was cooled by means of solid $CO_2$. Results were described by this investigator as follows: "Its properties would be completely changed—it would become essentially a hard steel, and it would remain a hard steel until it had actually been heated to a temperature of about 600C (112F)."

Osmond, the famous French scientist, in 1899 reported that hardened high-carbon steel, when cooled in liquid air (—317F) exhibited an increase in magnetic intensity, indicating a transformation of non-magnetic austenite to magnetic martensite. A considerable increase in hardness was also noted.

A few years later, Benedicks, a Swedish investigator, found that cooling hardened high-carbon steel down to the temperature of liquid air and allowing it to return to room temperature would cause a definite and regular specific volume increase. This change was also linked to the transformation of austenite to martensite, which has a lower density.

About 1918 Johnson, an American investigator, during the development of stainless steel alloys similar to the 18-8 austenitic types, observed the hardening effect of very low temperatures on certain corrosion-resistant steels. It was established several years later that some of the stainless steel alloys would harden to a considerable extent when cooled down to the temperature of dry ice or liquid oxygen (—297F).

In 1926 Tammann and Scheil, two German investigators, established considerable data on subzero treatments of high-carbon steels. They found that to obtain virtually complete transformation of austenite, it was necessary to cool high-carbon steel to about —220F.

It was discovered in 1927 that the considerable hardness increase attained by low temperature treatment of hardened high-carbon steel was not entirely due to the transformation of austenite to martensite. In fact, numerous

**TABLE 1—CONTRACTION OR SHRINK OF METALS**

Amount of shrink of a 2-inch diameter cylinder when cooled from 70F to the subzreo temperatures listed.

| Rockwell Hardness | Material | Subzero Temperatures, F | | |
|---|---|---|---|---|
| | | —110 | —160 | —320 |
| | | Shrink of Metal, Inch | | |
| C63 | High Speed Steel 18-4-1 | 0.0022 | 0.0028 | 0.0039 |
| C64 | High Speed Steel 6-5-4-2 | 0.0021 | 0.0026 | 0.0040 |
| C65 | High Speed Steel 18-4-2 + 9Co | 0.0020 | 0.0026 | 0.0035 |
| C64 | High Speed Steel 5-4-4-4 | 0.0025 | 0.0032 | 0.0045 |
| C67 | High Speed Steel 4-5-4-1 + 12Co | 0.0020 | 0.0023 | 0.0031 |
| C66 | Tool Steel 1.10C | 0.0024 | 0.0028 | 0.0039 |
| C63 | Tool Steel 90C 1.20Mn 0.50Cr 0.50W | 0.0023 | 0.0027 | 0.0040 |
| C66 | Tool Steel 50C 1.90Cr 1.25W | 0.0024 | 0.0029 | 0.0036 |
| C64 | Tool Steel 2.25C 12.00Cr 1.00Mo | 0.0025 | 0.0027 | 0.0040 |
| C58 | Chr Vanadium Steel (SAE 6150) | 0.0026 | 0.0029 | 0.0044 |
| B86 | Machine Steel (SAE 1020) | 0.0023 | 0.0028 | 0.0044 |
| B85 | Cast Iron | 0.0022 | 0.0025 | 0.0037 |
| B82 | Stainless Steel (18-8) | 0.0033 | 0.0041 | 0.0057 |
| B60 | Brass (66-34) | 0.0041 | 0.0046 | 0.0072 |
| F82 | Copper | 0.0036 | 0.0038 | 0.0062 |
| F78 | Bronze (SAE 660) | 0.0038 | 0.0043 | 0.0065 |
| H64 | Aluminum (25) | 0.0043 | 0.0056 | 0.0062 |
| E98 | Aluminum (24St) | 0.0031 | 0.0055 | 0.0080 |
| H79 | Magnesium (M) | 0.0051 | 0.0063 | 0.0094 |
| B78 | Invar "36" | 0.0003 | 0.0005 | 0.0011 |
| C69 | Cast Alloy 20Co 8W 7Mo 5Cr 2V 0.7C 0.7B Bal. Fe | 0.0018 | 0.0022 | 0.0029 |
| C58 | Cast Alloy 44Co 17W 33Cr 2.25C 2Fe | 0.0020 | 0.0025 | 0.0035 |
| A91 | Carboloy (Grade 44A) | 0.0003 | 0.0006 | 0.0015 |

experiments using subzero temperatures as low as —423F (liquid hydrogen) indicated that the major portion of the hardness increase was due to carbide precipitation. This is apparently one of the earliest, if not the first, accounts of precipitation hardening of carbon steel.

In 1932 Luerssen and Green described some cold treatments of certain alloy steels. One of these alloys was a 25% nickel steel similar to the one used in the Hopkinson experiment nearly a half century before. It was found that a subzero treatment of —297F would increase the hardness of this alloy as much as 29 points on the Rockwell C scale. In a similar alloy, with a combination of subzero treatment and elevated temperature aging, they were able to raise the hardness 52 points from the "as forged" condition.

It has only been in the last decade that practical use has been made of subzero treatments except for some stabilizing, shrink-fit assembling, and possibly some control of aluminum age-hardening. It was not until 1937 that a Russian investigator reported that subzero hardened high-speed steel tools performed better and could be run at a higher speed than was possible with ordinary hardening. Further reports by Russian investigators and an MIT (Massachusetts Institute of Technology) research report indicated that subzero hardening would produce a combination of hardness, strength, and ductility unattainable by ordinary hardening.

## Means of Obtaining Subzero Temperatures

Probably the first used method for obtaining low temperatures for the treatment of metals was by packing the metal in solid $CO_2$, dry ice. By this method, it is possible to reach temperatures in the order of —90F. However, by making a mixture of crushed dry ice and acetone or alcohol, —110F can be produced. By using this mixture of dry ice and acetone under a relatively good vacuum, it is possible to produce temperatures as low as —170F.

Probably the next step in producing low temperatures is with modern refrigeration equipment. Commercial equipment that produces a temperature of —150F in a fairly large test space is now available. In special applications, equipment is available for producing —200F. The Construction Materials Laboratory of the General Electric Co. at Bridgeport, Conn., has recently acquired equipment, Fig. 1, for producing —150F in a test space of 25 x 25 x 14 inches. This equipment utilizes a Freon 22, ethane cascade cooling system.

If it becomes necessary to use temperatures lower than —200F, liquid gases are used. Liquid gases will produce temperatures as follows: liquid oxygen, —297F; liquid air, —317F; liquid nitrogen, —320F; liquid hydrogen, —423F; liquid helium, —452F.

## Subzero Stabilization

Prior to the time when subzero temperatures were readily available, it was common practice for machine-tool castings to be stabilized by subjecting them to the elements by leaving them outdoors for several seasons. This procedure usually exposed the castings to some zero or subzero temperatures followed by summer tempering, which was often sufficient to produce the required degree of dimensional stability. Now with the means for producing subzero temperatures readily available, much greater stability can be achieved in a matter of a few hours.

An example of the need for subzero temperatures, where a high degree of stability is required, can be cited in a set of plug gages which had worn under size on one end and had actually increased in size on the opposite end. A —160F cold treatment for from 5 to 15 hours increased the size of several of the gages from 0.0005 to 0.0008 inch per inch of diameter. Also, there was an increase in hardness of from 2 to 3 points on the Rockwell C scale. It is interesting to note that these particular gages were made before World War I and had been aging at room temperature for better than 30 years before subjected to this cold treatment.

It has been well established that the progressive dimensional changes in hardened steel are caused by the gradual transformation of retained austenite. This slow transformation causes a volume increase in the steel and will continue to do so until practically all the retained austenite has been transformed. Of course, a series of long tempers at elevated temperatures will transform a large percentage of this austenite but will at the same time lower the hardness of the steel. In applications such as precision gages, high hardness as well as dimensional stability is required, thus it is imperative that subzero treatments be used for stabilization.

An MIT research report issued in 1944 states that virtually complete transformation of retained austenite to martensite can be accomplished by cooling to the range —250F to —260F, provided the subzero treatment is applied immediately after quenching. However, for most ap-

plications, including all types of gages and precision gage blocks, a series of subzero treatments in the order of —150F is adequate to give satisfactory stability. Gage blocks have been stabilized to within 0.000002 inch by cooling the blocks from room temperature to —120F five or six times during the final finishing operation. In such cases, each subzero cycle is usually followed by a low temperature draw, which should be low enough to maintain a hardness of Rockwell C 65 in the block.

For ordinary gages and machine parts, such a high degree of stability is not necessary. Thus, one or possibly two cycles of subzero treatment, followed by a low temperature draw, is sufficient for most of these applications.

## Subzero Assembling Processes

One of the earliest and most useful applications of subzero temperatures was in the assembling of metal parts either by what may be called the expansion-fit process or a combination of the expansion and shrink-fit methods. Shrink-fit assembling involves the heating of the outside fitting and then allowing it to shrink around the center plug, stud, or bushing. Many times this procedure was impractical or even impossible due to the damage caused by the high heat that was necessary. Certain steels and most aluminum alloys are damaged if heated to the temperatures required for shrink-fit assembly, but by subcooling the internal part, heating of the external part is either eliminated or reduced to a tempreature that will do no harm.

The following list points out a few of the applications of subzero assembling. However, this covers only a fraction of the many uses:

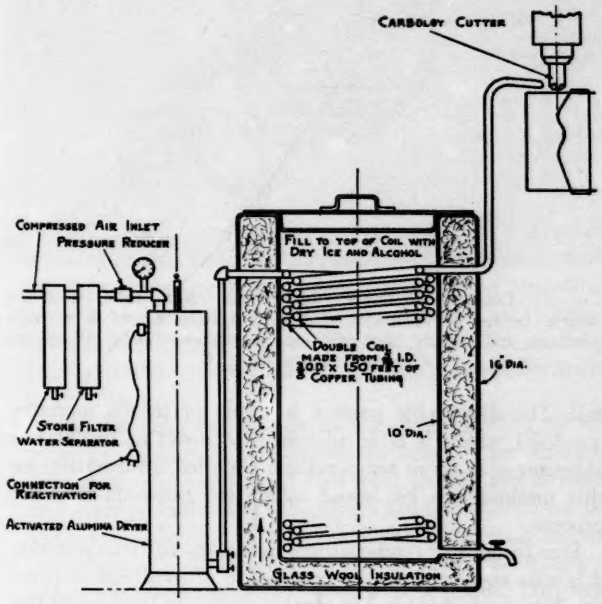
(1) Assembling of cast alloy valve seat rings in automobile cylinder blocks.
(2) Placing an alloy steel ring around coining or cold forging dies to prevent splitting.
(3) Assembling case hardened ring gears without tempering the case.
(4) Insertion of steel ball bearing races in a cast iron housing.
(5) Assembling of thousands of bearings and bushings of all sizes and shapes.

Low temperatures are also useful in removing certain parts that have been assembled by this method. In cases of rather large bushings, for example, it is possible to insert a tight fitting cup-type container filled with a subzero cooled convection fluid. Under favorable circumstances and with low enough temperatures, it is possible to remove bushings and similar parts in this manner.

Table 1 may be used as an aid in establishing allowances for subzero assemblies. These data were obtained by the Construction Materials Laboratory of the General Electric Co. by using test specimens two inches in diameter and one inch long with a 3/8-inch center hole. Each specimen was cooled from 70F to —110F, —160F, and —320F, respectively. Actual contraction of the 2-inch diameter was measured with the test pieces at the respective subzero temperature.

## Control of Age Hardening With Low Temperatures

The best known and probably the most important application of low temperatures is in the delay of age-hardening of aluminum rivets. Heat treated rivets of the 17S or 24S type aluminum alloys begin to age-harden almost immediately after quenching. To keep the rivets in a soft and satisfactory condition for driving or upsetting, it is necessary to retard the age-hardening action by suitable cold storage. The 17S aluminum alloy will begin to harden approximately one hour after quenching, and the 24S alloy starts hardening after about 15 minutes. By storing these rivets at 32F immediately after quenching, age-hardening can be delayed for about two days, but by using subzero temperatures of —40 to —50F, this hardening action can be suspended for several weeks.


Carboloy Cutter
Compressed Air Inlet
Pressure Reducer
Fill to top of Coil with Dry Ice and Alcohol
Double Coil made from 3/8 I.D. 3/8 O.D. x 150 Feet of Copper Tubing
16" Dia.
10" Dia.
Stone Filter Water Separator
Connection for Reactivation
Activated Alumina Dryer
Glass Wool Insulation
Fig. 2. Subzero air-coolant apparatus.

This low temperature retarding of age-hardening is also applicable to punched and formed parts made from 17S or 24S aluminum alloys. Parts from these materials can be heat treated after the blanking operation and stored at subzero temperatures until ready for the forming operation. This procedure is especially applicable to thin sections and intricate parts that may become distorted if heat treated after forming.

## Mercury Molds for Investment Casting

Within the last ten years the process of investment casting has become a very important tool in the production of precision parts. However, it is by no means a new process since wax patterns have been used in the "lost-wax" method as far back as 1540, as recorded by Biringuccio in his *Pirotechnia.*

The principles of investment casting are very simple. A replica of the finished casting is made of wax or other suitable material and "invested" in plaster. This "investment" is then allowed to harden, after which it is heated to remove the wax pattern. Metal is then cast into the remaining cavity.

When it comes to reproducing intricate details, the "lost-wax" process is often not good enough. By using essentially the same method outlined and changing the wax to frozen mercury, it is possible to reproduce greater de-

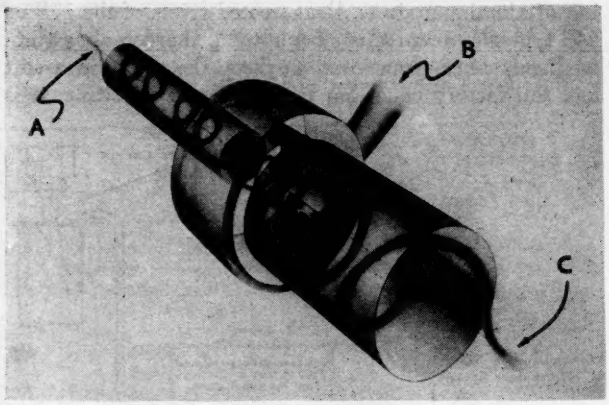



Fig. 3. Diagram of the Ranque-Hilsch vortex tube. Cold air leaves center of vortex through small tube **A**; at **B** is high pressure air supply; hot air leaves circumference of vertex through large tube, **C**.

tail. The disposable pattern is made of frozen mercury (—38F) which is later allowed to run out of the plaster investment at room temperature. Detailed information on this method can be found under the patented Mercast process.

Due to the low temperatures necessary for this process, it is only applicable to the production of small lots at present. However, it is used in certain instances because of the advantage of greater precision and better surface finish.

## Subzero Air Coolant for Metal Cutting

The rather unusual application of low temperatures for cooling cutting tools during operation has been investigated by the Construction Materials Laboratory with very good results. For example, tool life of small Carboloy milling cutters has been increased more than 400% by applying a subzero cooled, compressed air stream on the cutter edge during the milling operation. This procedure not only increased the cutter life but also made it possible to obtain a smoother finish. Fig. 2 is a diagram of the apparatus used in this investigation.

By using a subzero air coolant, it is also possible to use successfully cutters made from a tool steel having low "red hardness," such as tungsten finishing steel. Tools made from such steels can be run at a much higher speed than normal under this coolant without danger of tempering or hardness reduction.

In the 1870's James Clerk Maxwell, eminent British scientist, suggested the possibility of hot and cold air coming from the same tube. This was a result of his work on "Maxwell's Law" which states that molecules of gases exhibit a definite arrangement, whereby some circulate at considerable speed and are hot while others remain relatively static and are cold. Maxwell even suggested that "an intelligent demon" be placed at a trap door to separate the molecules into two streams, one hot and the other cold. It was not until some 60 years later that Maxwell's idea became a reality. Rudolph Hilsch, investigating an arrangement described by Rangue in 1939, developed a tube which, when compressed air was blown in the side through a tangential nozzle, would produce cold air from one end and hot air from the other, simultaneously. Fig. 3 is a diagram illustrating the essentials of the tube and showing the path of the air.

With such a tube it is possible to produce temperatures of 390F and minus 56F simultaneously. Since the efficiency of such a set-up is rather low as compared to commercial refrigeration equipment today, there has never been a satisfactory application for the tube. However, it is possible that it might be used very effectively for cooling metal cutters during machining operations.

## Low-Melting Alloys for Short-Run Forming Dies

There are a number of low-melting alloys which have excellent casting characteristics. A number of these alloys approach the quaternary eutectic of lead, Pb; bismuth, Bi; tin, Sn; and cadmium, Cd in composition and have melting points (154F) lower than that of boiling water. Also, these alloys containing as high as 50% Bi expand on cooling which makes them useful in reproducing detail work. This combination of low-melting point and expansion on cooling makes these alloys easy to use with a minimum amount of equipment and time required in design.

One of the most important uses for material of this type is in the fabricating of short-run forming or stamping dies. Dies of this material can be made up in a matter of a day whereas similar dies machined from tool steel would require weeks to complete. By subjecting dies made of these low-melting alloys to temperatures of –320F by immersion in liquid nitrogen, quite a few parts can be formed before it is necessary to freeze the die again.

Fig. 4 shows such a die used by the General Electric Company for making a sample lot of a part for a range switch. The base is steel but the top section is a low-melting alloy containing approximately 50% Bi, 14% Sn, 10% Cd, and 26% Pb. Although it is difficult to measure the hardness of such alloys very accurately, Table 2 gives an indication of the hardness increase in this particular alloy when immersed in liquid nitrogen (–320F).

Obviously, at such a subzero temperature, the wear resistance of these low-melting alloys is greatly increased making possible the production of sample lots of sheet metal parts very rapidly and economically.

## Supplementary Treatment in Hardening Steel

The use of subzero temperature treatments as a supplement to standard heat-treating procedures is one of the more recent low temperature applications. The effect of such treatments on different steels has been investigated by several parties thus far with varying results.

It has been established that in certain high alloy steels, the failure to obtain full hardness on heat treatment is mostly due to the presence of retained austenite. Although with proper heat treatment, it is possible to hold this retained austenite to a minimum, it is impossible to trans-

**TABLE 2—HARDNESS OF SPECIAL ALLOY**

| Temperature of Test Specimen, F | Hardness Readings | | |
|---|---|---|---|
| | Rockwell Diamond Pyramid, 5Kg Load | Brinell 10mm Ball, 250 Kg Load | Brinell 10mm Ball 500 Kg Load |
| 70 | 11 | 14 | — |
| —320 | 65 | 60 | 47 |

form 100% of the austenite in most high alloy steels even with the best heat treatment.

A steel such as 18-4-1 has approximately 20% retained austenite in the structure when it is cooled from the hardening temperature only to room temperature under the best conditions. However, it has been proved that by continuously cooling 18-4-1 steel from an austenitizing temperature of 2350F to —150F, only 8% austenite remains untransformed. Further cooling to temperatures as low as —310F does not succeed in transforming this remaining 8% austenite. Also, continuous cooling from the hardening temperature to a low temperature of only 0F will transform half of the 20% austenite retained at room temperature.

Although it has been established that subzero temperatures are necessary for the most complete possible transformation in certain high alloy steels, the effect which these temperatures have on the physical properties of the material has not been well established. The composition, design, and heat treatment of a certain tool or die all have a considerable influence on the effect which a subzero treatment might have on the particular tool or die. For example, experience would indicate that high carbon, high cobalt steels are more benefited by low temperature treatments than are the 18-4-1 or 6-6-4-1 types of high-speed steel. Also, from the standpoint of design, tools such as gear cutters which are ground on the tooth face only will usually respond better to cold treatment than tools which are ground all over. There are three variations in commercial heat treating practice that tend to leave the steel in a condition that might be improved by cold treatment. They are:

(1) By drastic overheating during austenitizing
(2) By carburization
(3) By stopping the hardening quench above room temperature before tempering

Under the above conditions, comparatively large amounts of austenite are retained after hardening thus making a subzero treatment very effective and sometimes necessary in order to salvage the part.

Air hardening steels have very high hardenability but often exhibit a tendency to remain in the austenitic condition after hardening. In this condition, these steels tend to possess low hardness and are difficult to grind. If, after a reasonable hardening treatment, these steels fail to show a hardness of at least Rockwell C60, a subzero treatment will usually increase the hardness several points on the Rockwell C scale. If such a hardness increase is obtained, it is imperative that the freshly formed martensite be tempered back before attempting to grind the steel. After eliminating the majority of the retained austenite and tempering the newly formed martensite, it is generally found that this steel exhibits little or no tendency to develop grinding cracks on subsequent grinding operations. This fact is the source of some speculation: That increased grindability can be realized in air hardening steels by incorporating a subzero treatment in the usual hardening procedure.

Fig. 4. Die used by G-E for making a sample of a part for a range switch. Left to right, low-melting alloy top section, steel base, and sample part produced in the die.

Ball bearing steels such as the SAE-52100 type also exhibit a tendency to remain austenitic after ordinary hardening and tempering. This will result in low hardness and dimensional instability which are two conditions that cannot be tolerated in ball bearings. However, a subzero treatment of —150F after the first temper will usually increase the hardness of this steel several points. This treatment is now used rather extensively in the bearing industry today to meet the exacting hardness and dimensional requirements.

Although it might seem at first glance that low-temperature treatments will right all wrongs in hardening operations, this is by no means the case. For, in the final analysis, the most important use of low temperatures as a supplement to heat treatment at present is in salvaging high-alloy steel tools and dies that have received an improper hardening treatment.

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## Air Conditioning Improved in Super Constellations

Lockheed engineers believe that the air cooling equipment for new Super Constellation transports will have a comfort capacity considerably greater than other airliners. Increased refrigerating capacity, 17 tons, will keep passenger cabins, while at airports and during taxiing, about 70F even though the outside temperature may reach 100F or higher.

Heating equipment will hold a steady 75F in flight throughout passenger spaces even though the high altitude temperatures may be as low as minus 60F. Generally heat is supplied from ceiling grilles. Pilots have foot warmers which send heated air across the control pedals of the plane.

# Theory vs. Practice in

# Radiant Heating

T. NAPIER ADLAM

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**So much has already been written regarding radiant heating that it may be profitable at this time to examine what phases of this subject are theory, what practice, and most important, what has been learned about both. Such an objective presentation has been prepared by an outstanding authority on radiant heating. Part I of this six-part article covers some of the theory.**

WHILE travelling in Europe some months ago, I was interested to learn that although radiant heating, as we now know it, received its advent in England, and many installations were made in that country years before it received any serious consideration here, there appeared to be an atmosphere of apprehension among some of the younger heating engineers and architects concerning the results from some methods of application and also concerning the fundamental principles of radiant heating generally. To this condition, some American writers may have contributed, since articles appearing in American journals are carefully studied in England, resulting in added confusion in the minds of thoughtful engineers.

Two of the most widely discussed questions in regard to radiant heating have already received some attention in America, and appear to be of sufficient interest to investigate. One problem, which caused some doubt, seems to have originated from various claims made as to the relative values of radiation and convection from heated panels at comparatively low surface temperatures, especially in certain locations; the other important problem which impressed me was one relating to the total heat emission from heated panels, especially from heated floors.

Method for providing comfort in 52 B.C.

While floor heating is known to have existed in Europe and Asia nearly 2,000 years ago, and it has been used in many schools and hospitals in England since its second advent nearly forty years ago, ceiling and wall panels have apparently received more attention than floors during the latter period, for (1) metal panels were made available for the ceiling and wall positions and (2) there was much printed data, of a sort, concerning these panels which gave engineers and architects some information which was not then generally available to the trade for other types and locations of radiant surfaces. However, since floor heating appears to be receiving more attention in Europe than formerly, and the question of location and heat output comes to the forefront, I was asked the question many times, if from American experience it is true that the theory associated with radiant heat differs with the results obtained in actual practice. This raises a somewhat contentious problem and has the aspect of a very old subject which for ages has provided a topic for discussion in almost every phase of life. I refer of course, to "theory vs. practice." We are therefore, compelled to face the question, "What have we learned about both?"

I can quite understand how easy it is to feel perplexed over data compiled from what appears to be experiences with radiant heating considering that heat is so illusive. When taken seriously, the whole subject of heating simply bristles with all kinds of intricate problems. It seems to me that one of the reasons why the theory of radiant heating does not always appear to agree with practice is that we know very little about either, and this brings up the problem of what the theory is of which we often read, and what is the practice which seems to challenge this somewhat fascinating theory. We all get experiences occasionally which seem to upset our previous concepts of heating, and often in trying to expound a theory of our own, we find ourselves on moving ground. The principle reason is that when dealing with the heating of buildings, we find heat will not stay put long enough to strengthen our own observations. The final result is that as we grow older and gain more experience, we learn to be more careful when we attempt to break down an old theory in an effort to find a new one.

In trying to explain a theory, much depends on the particular theory we are considering. Basically, a theory may

be a mere hypothesis, speculation or conjecture, or as in mathematics, it may be a body of principles or theorems belonging to a particular subject. We do know that while some theories are vague and are based entirely on suppositions, a theory can be a formulated statement, or system of standards based on observations, actual facts and experiences, presenting the laws or principles in such a way that they can be followed as a guide to fairly accurate conclusions.

Continual investigation, if done intelligently, may eventually result in the discovery that the present theory regarding radiant heating holds fairly well when correctly applied and when other factors are better understood and placed in their proper perspective. On the other hand, it may be that we shall eventually discover that something entirely different is happening, even though the final results remain approximately the same.

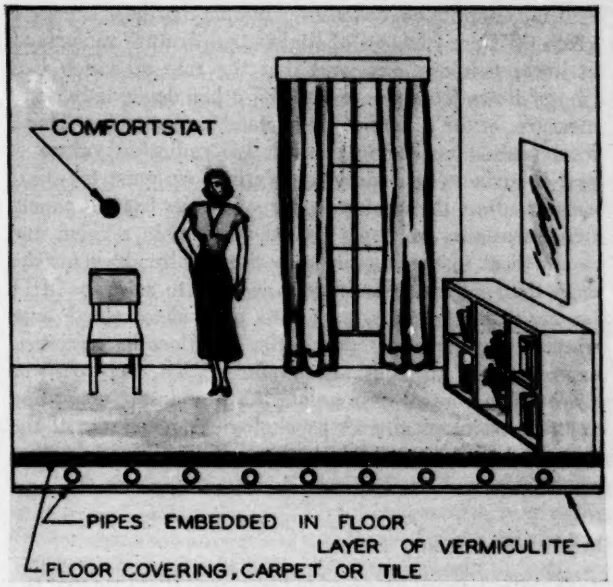
It must be very gratifying to all heating engineers, architects, and others interested in human comfort and health, to learn what is being done and contemplated at the ASHVE Environment Laboratory in Cleveland, Ohio.

Enormous sums of money are being spent just now in exploring the upper researches of the atmosphere in what some would consider as basic research. The Army and Navy needs this information about the unexplored region of the air to which they would like aircraft to ascend. This we agree is very necessary to the safety of our country, but the safety of a nation depends as much on the health of its people as it does on guns and aircraft.

## Research Work is Important

Unbiased information has to be the result of much research work which not only takes time, but costs money. Lots of money! All my life, since being associated with the heating profession, which was before I left college, I have been fortunate in being associated with firms that not only could afford to spend money on research work, but the principals realized its value and were intensely interested in research work generally. I know from experience that considerable time and money is necessary to obtain reliable information concerning even the most simple problems of heating and heating equipment. Undoubtedly, it pays any firm to carry out research work since it invariably helps to keep that company in the front in their particular field, but since our Society has an obligation to give unbiased answers to all problems concerning health and comfort, it should have all the help members can give.

It appears reasonable to suggest that a theory that has proved fairly safe for 30 or 40 years should not be lightly thrown aside simply because some contradictory results may suddenly appear on our horizon, especially if these results are not fully understood. I do not wish to appear dogmatic, because in speaking of a theory one realizes that a theory is itself an invention and may not be a statement of absolute truth. Like any other invention, a theory is discarded when it ceases to be useful and, therefore, I use, advisedly, the expression "not fully understood" because I believe we are all somewhat in doubt as to many things concerning radiant heat, even to the question of what it is. Already we find that opinions differ widely as to how radiant energy is transmitted through space, and what it actually does to the human body.




Providing heating comfort in 1952.

Viscount Samuel, President of the Royal Institute of Philosophy, when speaking recently of the theory of relativity is reported to have stated that he holds the impression that contemporary physics is based on concepts somewhat analogous to the "smile of the absent cat." Men like Descartes, Lord Kelvin, Newton, Huygen, Fresnel and several others have held different views amongst themselves as to the presence of ether and the transmission by wave motion or other means of light and heat energy.

Even as I write this article, we are being treated to another new theory of electrodynamics by one of Britain's most original mathematical physicists—Prof. Dirac of Cambridge University, a Nobel Prize winner. He brings back ether, which was believed to have been exorcised, relatively speaking, by the Einstein field theories of 1905. We have a revival of the 300-year old etheral ghost of physics at a time when it seems very few physicists can be found who would openly state they believed in it. I understand Prof. Dirac makes full use of the quantum theory and has carried the theory of relativity several steps further with the aid of a new ether. Therefore, when dealing with our relatively small problems of heating, it seems permissible to say that we all may be forgiven and our views tolerated if we hold different opinions as to the true value of heat given off from a heated panel or carpets under various conditions of temperature and location, and the ultimate effect on the human body.

I believe it was Sir William Bragg who once said that the ether theory of transmitting energy seems to work on Mondays, Wednesdays, Saturdays, but not on other days of the week. The same remark may be expressed by all heating engineers concerning our present idea of heat losses and heat gains, because for no apparent reason whatever, the total heat losses from a building undoubtedly do vary from day to day independently of temperature difference between the outside air and the air temperature in the rooms. I have veered from heat emission from panels to total heat losses, and I do this because a little later in this article I wish to introduce a phase which I believe will help to explain some of the inconsistencies which appear to cause most of the trouble.

It is generally conceded in principle that heat energy is given off from surfaces of higher temperature to surfaces at lower temperatures, and that the rate at which heat energy flows from the one to the other depends in some measure on the difference in surface temperatures. Therefore, when considering the relative radiation values of heated surfaces according to location, we must take into consideration the real purpose of these heated panels. Fundamentally, we apply heated surfaces in a room, not to add heat to the human body which already generates more than sufficient for its own use, but to raise the MRT (mean radiant temperature) to a predetermined level whereby we hope to regulate the heat loss by radiation from the human body. In so doing, we aim in some measure, to control or regulate the heat losses according to the physiological and psychological reactions of the body and thereby provide both comfortable and healthy conditions.

## MRT a Controlling Factor

Therefore, when we provide floor heat, it is true that the surface temperature of the heated floor may be lower than the average surface temperature of the human body, but, nevertheless, we have achieved our object in maintaining comfort by what we imply as radiant means if we have provided a sufficiently high MRT of all surfaces with corresponding air temperatures compatible with the needs of the human body. Thus, it seems possible under correct conditions of design, to have an equally effective radiant heat system by using the lower temperature radiation surfaces on the floor, as when providing higher temperature surfaces in walls or ceilings.

The conditions thus created are somewhat analagous to those outside conditions we find so pleasant on a summer evening when the air is comparatively cool, and the surrounding earth, trees, and other objects have been raised to a moderate temperature during the day by the heat absorbed from the sun. Although these objects remain at temperatures below that of body, they are sufficiently warm to control heat loss from the human body within the limits of comfort. The actual results in a room will, of course, depend largely on the MRT of the unheated surfaces in relation to the actual area and temperature of the heated surface, which is something we can invariably take care of.

While it can be claimed with a considerable degree of accuracy that this low temperature radiation may provide the same general feeling of comfort as that provided by higher temperature surfaces, or by long wave radiation from surfaces heated by the sun, it cannot be conceded that the health giving energy emanating from the sun is present in the radiation from heated panels. When speaking of the sun's effect, it is extremely doubtful if we have any true conception of what affect the sun has on the human body, or even what function the sun performs. It seems safe to say, however, that it was not until Prof. Einstein formulated his now familiar algebraic mass-energy equation, which indicates that mass can be converted into energy and energy into mass, that it was possible to account for the sun's light and heat. While it seems to be generally conceded that the sun radiates light and heat because in its interior billions of nuclear bombs are exploding every second, there appears to be considerable controversy as to how the hydrogen in the sun is transmitted into helium and energy, and according to recent investigations many astrophysicists believe that we shall have to change our conception of the sun's structure.

Since the days of Faraday and Maxwell, the conviction seems to have established itself that "mass" has to be replaced by a "field" as a basic element for construction of "reality". Otherwise, how will it be possible to reduce light which apparently can be represented only as a "field", to material elements in motion. The conviction of the non-existence of a "stationary ether", which apparently existed before the announcement by Prof. Dirac and followed from the special theory of relativity, appears to have been the last step in the transition from the concept of "mass" to that of "field".

## Interpretation of Theory

Those who regard the contemporary quantum theory in connection with the transmission of light and heat as a piece of knowledge which is final in principle, generally waver in fact between two possible interpretations, namely:

(1) A physical reality, where its laws, however, do not allow of other than statistical expression, and

(2) Nothing at all which corresponds to a physical situation, and that only probabilities exist.

While we are still left in doubt as to how heat is generated in the sun, and the exact means heat energy is conveyed through space, this need not seriously affect in anyway the principles we have adopted for providing comfort by low temperature heated panels, but it may explain that even though we raise panel surfaces to a very high temperature, we still fail to create the full beneficial affect of our old friend, the sun. However, we may go a little further and say that for many years it has been conceded that low temperature radiation provides a more comfortable condition and healthy atmosphere than very high temperature surfaces, and certainly is more economical.

## A Health Angle

It is perhaps unfortunate for reliable heating engineers that some writers and artists have undoubtedly described in glamorous terms and with wild imagination, the health giving rays emitted from low temperature radiation in an enclosed room as approaching that of the sun. On the other hand, if low temperature radiating surfaces are correctly constructed in a room to provide comfort with more healthy conditions than the dry and scorching atmosphere which often resulted from many old time steam heated and hot air systems used in the past, it may be that unwittingly, these non-technical but glamorous articles contain more truths than many of the articles which, under the guise of progress, seem to be intended to either confuse or direct the mind from a better method of heating. From this we may go a little further and say that while it appears to be conceded that low temperature radiation cannot contain all the health giving energy we receive from the sun, we are reminded on almost every summer vacation we take, that direct rays from the sun continually impinging on the skin can, under some conditions, prove to be very harmful.

After over 30 years experience with the various types of radiant heat panels now in use, it seems safe to say in most cases some radiant heating in one form or another is an essential feature for comfort, and is one of the greatest assets to the heating engineer if he wishes to provide

both comfortable and healthy conditions. The same remark will apply equally well to radiant cooling when this phase of providing comfort conditions in hot weather has received the attention it deserves.

If better reflecting surfaces can be developed for the unheated surfaces which will harmonize with the other parts of a room, and more efficient insulation is provided to reduce heat losses, it will eventually be possible to reduce considerably the area and temperature of any type of heated panel. However, radiant heating panels should be considered as one of the methods available for providing comfort conditions and not as the only method for all types of buildings. No reliable heating engineer should become a slave to any one type of system for providing comfort conditions in a building.

### One Design Not Always Best

It is true that all heated surfaces will give off some of the heat we know as convection, regardless as to the position, providing it is surrounded with air. Many installations can be successful when using radiant heat surfaces only, especially in residences and offices. On the other hand, some rooms may require supplementary heat in the form of convected heat to deal with a large amount of ventilation, as in classrooms, while others may require the addition of radiators or baseboard panels to deal with excessive or local heat losses through walls or windows. Then again, there are many cases where special conditions of location and occupation require movement of air to avoid monotonousness, and where possible, some provision should be made to blend the movement of air with the MRT of the room.

There does not appear, however, to be any substantiated evidence that any one of the locations whether wall, ceiling, or floor, is the best or most correct method for every type of building and condition. The most important provision is to see that the surface temperature of the floor is not raised too high for comfort and health, and that the water circulating in the coils of walls and of ceilings is not too hot to crack the plaster or concrete.

Just because it may be possible during a test run to pass hot water through coils in plaster ceilings or concrete floors at temperatures approaching 200F without cracks developing, it must not be assumed that such high temperatures are safe for regular use. Some day the internal stresses and strains created by such high temperatures may prove too much for the strength of the material and a catastrophe of the first magnitude will result. It does seem unfortunate that while many theories are expounded as to what can happen to the energy emitted from a heated surface, very little attention is given to the method of application and to the quality of workmanship. The result is that many owners of residences and industrial plants find themselves worse off than when relying on the older methods correctly applied. Application will be considered in Part 2.

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## High Precision Sensing of Manometer Column

Differences in height, and thus in pressure, between the two mercury columns of a mercury manometer are being determined with high precision by an application of the National Bureau of Standards electronic micrometer principle. The new height-sensing technique was developed by M. L. Greenough and W. E. Williams of the National Bureau of Standards electronic instrumentation laboratory, to meet special pressure-measurement requirements arising at the Bureau. Based on the use of high frequency mutual inductance probes, the method is sensitive to height changes of as little as 0.0005 inch. It also has the advantage of not requiring direct visual observation of the mercury surfaces; the mercury columns need not have transparent windows, and readings can be made at a distance. Since no float or electrical contact is required, disturbance of the mercury surface is minimized. Therefor, a possible complication of the application is avoided.

Above the mercury surface in each column is mounted a mutual-inductance probe consisting of a primary and a secondary coil. When the primary coil is supplied with constant radio-frequency current, the voltage induced in the secondary varies with the mutual inductance or coupling between the two coils. The mutual inductance, in turn, varies with the proximity of the mercury surface; the closer the mercury surface is to the probe, the greater is its shielding effect, and the less the output voltage. The output voltage thus becomes an index of probe-to-mercury distance, and can be used to indicate this distance with high precision.

In the present NBS arrangement the electronic circuit, except for the two probes, is contained in two small cabinets, one for each mercury column. Each cabinet is connected electrically to its associated probe and to the other cabinet. One zero-center microammeter on each cabinet is calibrated to indicate variations in the height-difference of the two mercury columns. When these differential-height meters read zero, the probe-to-mercury distances in the two columns are identical. The difference in the mercury-surface heights is then equal to the difference in the probe heights, which is known or determinable. With this form of null indication, the mercury columns may be reset accurately to the same differential height, assuring reproducible pressures. Since the differential-height meters have a measurement range of only about 0.04 inch, individual-height meters with a range of 0.3 inch are provided to facilitate preliminary adjustment of the mercury columns.

The primaries of the two probes are excited by a 480-kilocycle amplitude-regulated oscillator. A vibrating relay compares the outputs of the pickup secondaries by switching first to one and then to the other. The difference in the outputs is amplified, rectified, and applied to the differential-height meters.

# Heat Exchangers in Animal Shelter Ventilation

**An air-to-air adaptation of the shell-and-tube heat exchanger extracts heat from barn exhaust to temper ventilation air and salvage high latent heat gains. Experimental installations at Iowa State College and Ontario Agricultural College have been successful, as has a commercial exchanger at Plainfield, Ill. The following is based on papers[1,2] by Henry Giese, professor of agricutural engineering, Iowa State College, and others.**

THE problem of animal shelter ventilation is complicated by extremely high latent heat content, particularly at low outside temperatures. When exhaust air is discharged directly outside, the heat loss is so great in cold weather that it is usually necessary to restrict the ventilation rate in order to maintain inside temperatures at 50 to 55F. The result is an increase of inside humidity with resultant ill effects on the animals and increased condensation on building materials.

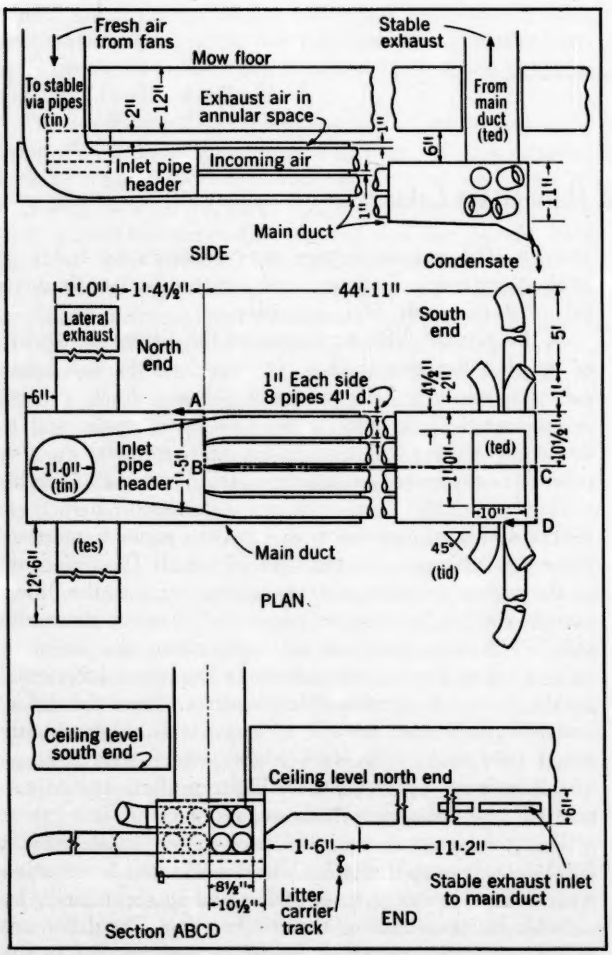


Fig. 1. Multitube, forced air heat exchanger.

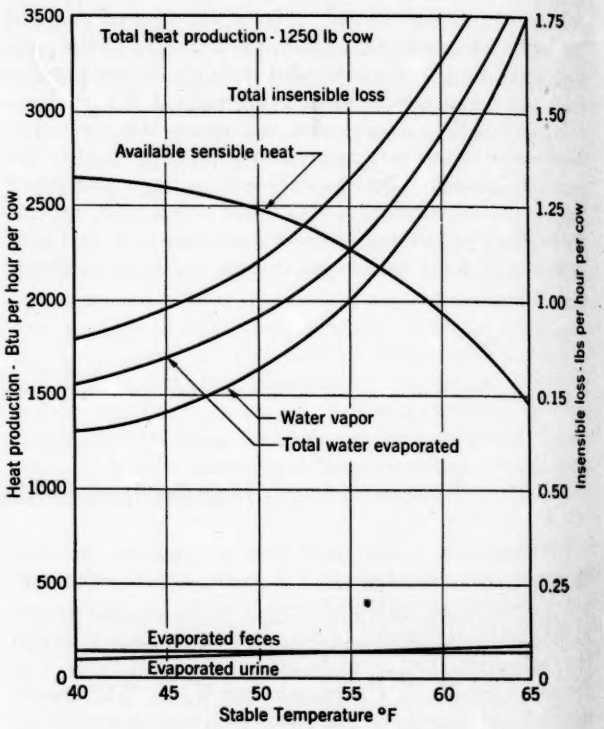
Total heat production - 1250 lb cow
Total insensible loss
Available sensible heat
Water vapor
Total water evaporated
Evaporated feces
Evaporated urine
Heat production - Btu per hour per cow
Insensible loss - lbs per hour per cow
Stable Temperature °F

Fig. 2. Heat and water vapor relationships.

Work at Iowa State College and Ontario Agricultural College has resulted in development of a heat exchanger consisting of multiple thin wall tubes enclosed in a sheet metal duct as shown in Fig. 1. Outside air is introduced through the small tubes and discharges at ceiling height. Exhaust air is picked up by lateral ducts from the opposite end of the stable, introduced into the exchanger duct surrounding the small tubes, conveyed through the exchanger in the annular spaces and subsequently discharged. Thus outside supply air in the pipes is warmed, and the warm exhaust air in the main duct is cooled as the two pass in parallel flow through the system. Condensate which forms on the cold air tubes is drained off and discharged.

[1]Giese, Henry, and Downing, C. G. E., Application of Heat Exchangers to Dairy Barn Ventilation, *Agricultural Engineering*, April, 1950.
[2]Giese, Henry, and Ibrahim, A. A., Ventilation of Animal Shelters by the Use of Heat Exchangers, *Agricultural Engineering*, July, 1950.

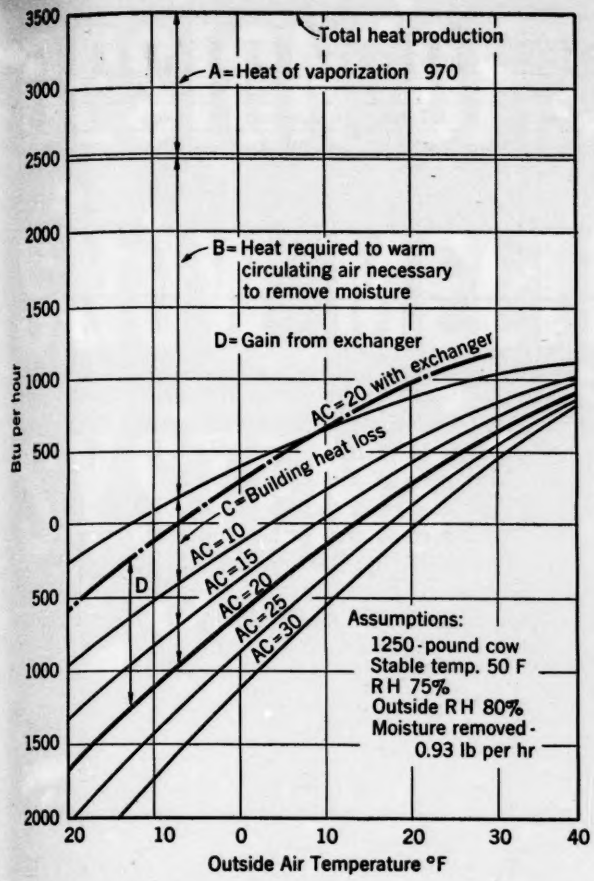


Fig. 3. Dairy stable heat balance.

The total heat transfer through the exchanger from warm air to cold air may be calculated from the equation

$$Q = UA\triangle t_m E$$

where $Q$ is the total heat transferred in Btu per hour; $A$ is the total area of thin pipe surface in square feet; $U$ is the overall conductivity of the pipe in Btu per (hr) (sq ft) (F); $\triangle t_m$ is the logarithic mean temperature difference in degrees Fahrenheit; $E$ is a factor for a multipass exchanger. Observed values of the heat transfer coefficient at various rates of air flow range from U = 1.01 at 4.0 cfs to 2.99 at 21.4 cfs without insulation on the duct and from U = 1.05 at 4.0 cfs to 3.37 at 21.4 cfs when the duct was insulated.

## Experimental Setup

The exchanger used in the experimental setup, shown in Fig. 1, consists of two rows of 4-inch diameter galvanized pipes on 5-inch centers contained in an outside duct 11 by 21 inches. The incoming air was discharged into the stable through these individual pipes. Both exhaust and inlet were manually damper controlled to regulate air flow.

The exchanger was intended to ventilate a 24-cow stable in which the temperature was to be maintained at from 50 to 60F and the relative humidity at or below 75%.

Usually there was condensation on the pipes of the exchanger unit when the incoming air entered the exchanger at temperatures below 30F. The maximum amount drained off for any 24-hour period was 12 gallons. The maximum increase in temperature of the incoming air from the heat exchanger of 32 degrees was accompanied by an 18-degree decrease in the exhaust air temperature.

## Savings

In a stable where zero heat balance occurs (that is where heat gained from the cows is exactly offset by transmission and ventilation losses) with ordinary ventilation at 18F outside temperature, occurs with the heat exchanger at 4F outside. Thus, stables may be ventilated at full rate with outside temperatures from 16 to 19 degrees lower when using the heat exchanger than when ventilating by some other means with untempered incoming air. The actual savings in ventilation heat loss when using the heat exchanger may be from 41 to 46%.

Above the zero heat balance temperature, there is a surplus of heat in the stable. This may be dissipated by circulating more air or decreasing the rate of heat transfer in the exchanger. Since the rate of transfer depends on air velocity in both incoming and exhaust air sections, maintaining the exhaust velocity constant as the incoming air velocity is increased will lower the transfer rate more than if both velocities are increased equally.

## Heat Balance

As the outside temperature increases and the need for conserving heat becomes less, the exhaust fan may be

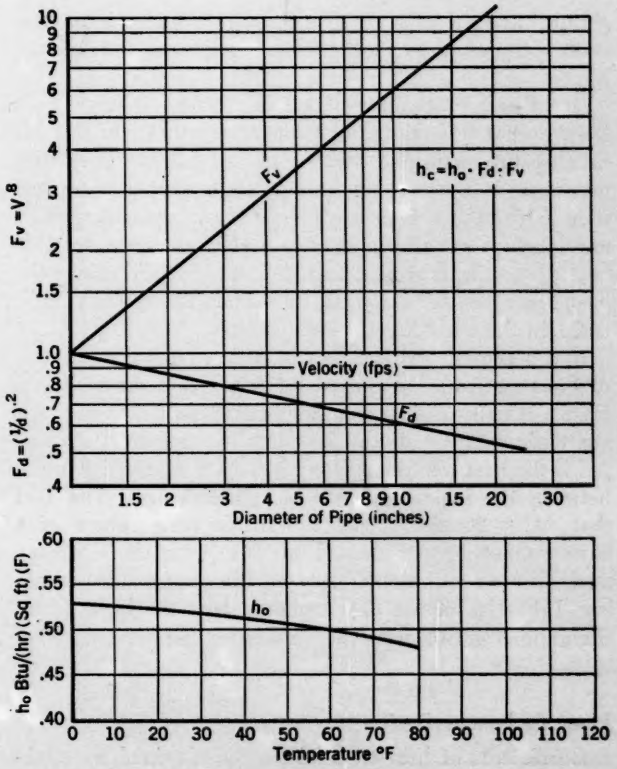


Fig. 4. Coefficient of heat transfer for forced convection of air.

**TABLE 1—HEAT BALANCE IN A DAIRY BARN**
(18-cow dairy barn, assumed infiltration 5500 cfh; AC = 20)

| Outside Temp., F | Inside Temp., F | Supply Air cfh | Heat Losses, Btu per hr | | | | Heat Gains, Btu per hr | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Evap. | Ventil. | Bldg. | Total | Animal | Exch. | Total |
| 30 | 61 | 75500 | 1400 | 2500 | 620 | 4520 | 3500 | 1100 | 4600 |
| 20 | 59 | 55500 | 1350 | 2400 | 780 | 4530 | 3500 | 1030 | 4530 |
| 10 | 55 | 55500 | 960 | 2810 | 900 | 4670 | 3500 | 1180 | 4680 |
| 0 | 45 | 55500 | 835 | 2880 | 900 | 4615 | 3500 | 1180 | 4680 |
| —10 | 42 | 45500 | 825 | 2780 | 1040 | 4645 | 3500 | 1130 | 4630 |
| —20 | 32 | 45500 | 730 | 2840 | 1040 | 4610 | 3500 | 1130 | 4630 |

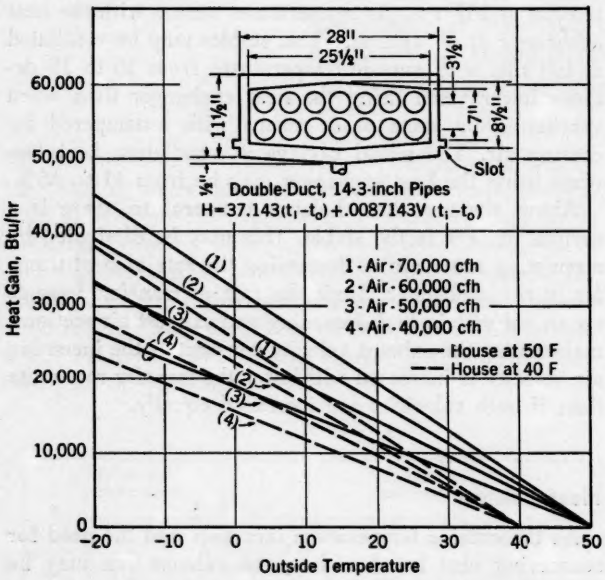


Fig. 5. Performance of heat exchanger for a barn of 18 cows.

shut off and the exhaust air removed through windows or wall openings, thus ventilating entirely with untempered air.

Total heat production of a 1250 lb cow is fairly constant over a wide range of temperatures at 3500 Btu per hr. The proportion of sensible heat to latent varies with temperature, however, so that at high temperatures less than half of the heat is sensible. The heat and water vapor relationships are shown in Fig. 2. The available sensible heat properties represent total heat production minus the heat required to evaporate the amounts of water indicated in the right-hand scale.

Fig. 3 shows a typical heat balance in a stable. Part A of the heat produced is used for vaporizing the moisture. Part B is used in warming the circulated air necessary for ventilation. Part C is the heat loss through the building. AC is the heat loss per cow per hour per degree difference between the inside and outside temperatures. The fact that AC = 20 shows that the inside temperature of a barn cannot be maintained at 50F with the ordinary methods of ventilation if the outside temperature is below 14F. Use of the exchanger enables the barn to be maintained at 50F with the outside temperature at —7F.

## Heat Exchanger Design

Coefficients of heat transfer can be obtained by established formulas concerning conduction, convection and radiation. A simple group of curves (Fig. 4) will give the coefficient of heat transfer if the diameter, velocity and average temperature of flowing air are known.

$$Q = M(\triangle h) = AU\triangle t_m E \qquad (1)$$

where M = mass of air, pounds per hr

$\triangle h$ = change in enthalpy of air, Btu per lb

A = surface area of heat transfer, sq ft

U = heat transfer coefficient, Btu per (hr) (sq ft) (F)

$\triangle t_m$ = long mean temperature difference for counterflow

$$= \frac{(T_2 - t_1) - (t_2 - T_1)}{\log_e \dfrac{T_2 - t_1}{t_2 - T_1}}$$

if $t_1$, $T_1$ = inlet and outlet temperatures of supply air, respectively, F

$t_2$, $T_2$ = inlet and outlet temperatures of exhaust air, respectively, F

E = factor for a multipass exchanger which can be obtained from any heat transfer book.

Knowing the coefficient of heat transfer and the temperature of inlets, the temperature of outlets can be assumed and the problem solved to fit equation (1).

## Range

A group of curves can be obtained (Fig. 5) which suggest the range of performance of an exchanger in an 18-cow barn.

Referring to the heat balance charts (Fig. 3), it will be observed that the temperature in such a barn can, by the use of a heat exchanger, be kept at 50F when the outside temperature drops to —6F. If the outside temperature falls to —20F the inside will stay above freezing.

It is undesirable to expect the operator to change the air flow with changes in outside temperatures and almost certain that he will open some of the doors or windows when the outside temperature is above freezing. A four-step regulator valve will reduce the labor needed for managing the exchanger:

(1) Air flow required when outside temperature is 20F or above is 70,000 cfh for 18 cows.

(2) Air flow will be 50,000 cfh for 18 cows when the outside temperature is between 20F and 0F.

(3) Air flow will be 40,000 cfh when the outside temperature is between 0F and —20F.

(4) Below —20F, the system circulates 30,000 cfh for 18 cows.

Table 1 shows the balanced temperature in the barn assuming infiltration to be 5,500 cfh and a 10 mph wind.

# DESIGN OF SNOW MELTING SYSTEMS

WILLIAM P. CHAPMAN

National Tube Division U. S. Steel Corp.

# Design of Snow Melting Systems

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**This article explains and illustrates the importance of including so-called consequent energy losses in calculations for the design of a snow melting system. Very often these losses, such as vaporization and convection losses, are considered insignificant and are ignored. It is the purpose to show here, however, that these terms are always significant, and should never be ignored.**

THERE are three unavoidable energy losses consequent to operation of a snow melting system: (1) the energy required to make up the heat of vaporization, (2) the energy required to make up the heat transfer to the ambient air and surfaces (convection and radiation), and (3) the energy required to raise the snow temperature to 32F (this is not really a loss, but it is a consequent energy requirement that is often neglected in design of the system).

The energy requirements that are often the only considerations in the design of a snow melting system are: (1) the energy required to melt the snow (heat of fusion), and (2) the energy lost to the ground below. In an actual example given later, these two requirements represent less than half of the total requirements.

The complete analysis, then, depends upon five energy terms. The sum of these five energy terms equals the total heat output from the heating plant. In addition, though, this total energy must be delivered by a circulating fluid which is maintained at a specific temperature. When the total heat and the fluid temperature have been determined, and a sketch is drawn of the coil layout, then the design is complete.

The determination of the fluid temperature and total heat output is accomplished in two phases: (1) the evaluation of the variables, and (2) the substitution of the variable into the energy equations. The first phase is treated in the next two sections, while the second phase is given in the Appendix.

## Selection of Design Data

To design a snow melting system, the engineer must determine the appropriate climatological data. These data are: (1) rate of snowfall, (2) wind velocity, (3) relative humidity (or vapor pressure), and (4) air temperature. The first item is given in Table 1. The last three items must be obtained from the local weather bureau. Unfortunately, there are no general data published on wind velocities, relative humidities, and temperatures during snowstorms. Table 2 gives these data for the record snowstorm for Pittsburgh, Pa., but it would be unwise to use the data for other areas or even for general design in Pittsburgh.

It must be borne in mind that a snow melting system may not have to operate during extremely heavy snowstorms. For example, the snow melting system in the sidewalk of a downtown department store would not have to be in operation at a time when shoppers could not get to the store. Perhaps for good will purposes it would be advantageous to keep the sidewalks clear at all times, but it would not be essential during periods when public transportation systems are inoperative. Even during a record snowstorm the snow melting system would not be completely inoperative but would probably be insufficient for just a few hours. Take the record storm of Pittsburgh shown in Table 2. From Table 1 we see that the expected snowfall rate for Pittsburgh is .08 inches of water equivalent per hour.* This snowfall rate was exceeded for 10 of the 24 hours. Starting at 8:00 a.m., the system could keep ahead of the storm for the first three hours. It would keep even on the fourth hour and it may fall slightly behind at noon. Then since the fall was .08 at 1 o'clock, the system would be just holding even and may not melt all of the snow from noon until 2 o'clock. At this time, however, the fall went down to .03 and the system could catch up easily. Starting at 5:00 p.m—which would be after shopping hours—the system may start to fall behind again and in all probability would remain behind until midnight or 1 a.m.

If, however, a snow melting system is to be designed for a bridge ramp or street intersection, or somewhere that is apt to be a traffic bottleneck, it may be advisable to design a system for the worst snowstorm for the locality.

In other words, the climatological data must be selected with respect to the locality, and with respect to the use of the snow melting system.

## Effects of the Variables

Regardless of the presupposed magnitude of the effects of the variables on the fluid temperature, those effects

**TABLE 1—DESIGN RATE OF SNOWFALL FOR VARIOUS CITIES**

(s = Inches of Water Equivalent Per Hour)

| City | s | City | s |
|---|---|---|---|
| Albany, N. Y. | .16 | Evansville, Ind. | .08 |
| Asheville, N. C. | .08 | Hartford, Conn. | .25 |
| Billings, Mont. | .08 | Kansas City, Mo. | .16 |
| Bismarck, N. D. | .08 | Madison, Wisconsin | .08 |
| Boise, Idaho | .08 | Minneapolis, Minn. | .08 |
| Boston, Mass. | .16 | New York, N. Y. | .16 |
| Buffalo, N. Y. | .16 | Oklahoma City, Okla. | .16 |
| Burlington, Vt. | .08 | Omaha, Nebraska | .16 |
| Caribou, Maine | .16 | Philadelphia, Pa. | .16 |
| Chicago, Ill. | .08 | Pittsburgh, Pa. | .08 |
| Cincinnati, Ohio | .08 | Portland, Maine | .16 |
| Cleveland, Ohio | .08 | St. Louis, Missouri | .08 |
| Columbus, Ohio | .08 | Salt Lake City, Utah | .08 |
| Denver, Colorado | .08 | Spokane, Wash. | .16 |
| Detroit, Michigan | .08 | Washington, D. C. | .16 |

Derived from U. S. Weather Bureau Data as analyzed in National Tube Company Bulletin, Radiant Heating with National Pipe, 1951 edition.

*The unit, *inches of water equivalent per hour*, is defined as the depth of water that would be obtained if the snowfall per hour were melted. The unit by-passes the need for data on density of snow because one inch of water equivalent per hour $= \frac{62.4}{12} = 5.2$ lb per (hour) (sq ft).

**TABLE 2—CLIMATOLOGICAL DATA FOR RECORD SNOWSTORM IN PITTSBURGH, PA.**

| Item | A. M. Nov. 24, 1950 | | | | | P. M. | | | | | | | | | | | | A. M. Nov. 25, 1950 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Air Temperature, $t_a$,F | 21 | 21 | 19 | 17 | 16 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 15 | 15 | 18 | 20 | 21 | 22 | 23 |
| Snowfall $s$* | .05 | .05 | .05 | .08 | .10 | .08 | .03 | .06 | .04 | .10 | .12 | .08 | .10 | .10 | .12 | .09 | .01 | .02 | .02 | .09 | .06 | .05 | .17 | .23 |
| Wind Velocity, $v$* | 18 | 12 | 16 | 14 | 8 | 14 | 12 | 12 | 10 | 12 | 8 | 12 | 14 | 11 | 14 | 13 | 13 | 10 | 15 | 16 | 12 | 15 | 10 | 9 |
| Relative Humidity, % | 83 | 81 | 79 | 77 | 82 | 79 | 79 | 84 | 82 | 82 | 86 | 82 | 76 | 81 | 79 | 83 | 84 | 84 | 84 | 87 | 87 | 88 | 89 | 87 |

*The units for snowfall, $s$, are inches of water equivalent per hour.
The units for wind velocity, $v$, are miles per hour.

should be at least roughly evaluated. It would be injudicious to neglect any variables arbitrarily.

There are four independent variables to consider: (1) wind velocity, (2) vapor pressure, (3) air temperature, and (4) rate of snowfall. Each variable will be discussed in detail.

(1) *The effect of wind velocity*—A graphical presentation of the effect of wind velocity on fluid temperature is given in Figs. 1 and 2. Equation (4b) in the Appendix, is the differential equation giving the effect of wind velocity on fluid temperature. The wind velocity is important because it affects the rate of evaporation and the rate of convection. In Fig. 1, for example, with $s = 0.08$ and with a change of wind velocity from 7 to 14 mph there is a change of fluid temperature of 39F, which is 33%.

(2) *The effect of vapor pressure*—In this article, calculations are based on vapor pressure in inches of mercury. For convenience in using vapor pressure data as reported by the weather bureau, Fig. 1 and 2 show vapor pressure as 90% R.H. The relationship of vapor pressure to relative humidity is shown in Fig. 3. Fig. 4 is a graphical presentation of the effect of vapor pressure, or relative humidity, on fluid temperature. The differential equation showing this effect is equation (4c) of the Appendix.

(3) *The effect of air temperature*—Air temperature has a complex effect on fluid temperature. The air temperature affects the vapor pressure of the air, the heat content of the snow, and the heat transfer from the film to the ambient air and surfaces. Because the effect is so complex, no differential equation is given in the Appendix. Graphical presentation, however, is given in Fig. 5. Notice, in Fig. 5, that for wind velocities of 14 mph, the fluid temperature goes from 106F at $t_a = 30$F, to 188.5F at $t_a = 0$F. Incidentally, it is very unusual to get snowfalls at temperatures less than 0F. Blizzards occur at lower temperatures but those conditions have not been considered in this article.

(4) *The effect of snowfall rate*—The effect of snowfall rate on fluid temperature is obviously very great. This effect generally is well understood; in fact, it is often the only variable that is considered in the design procedure. The differential equation showing this effect is equation (4d) of the Appendix. The graphical presentation is given in Fig. 6.

## Magnitude of Component Energy Terms

Table 2, climatological data for Pittsburgh's record snowstorm, shows that there are two critical hours, the 15th and 24th hours. The 15th hour, 10 p.m., is critical because of a low air temperature (12F) and a high snowfall rate (0.12 inches of water equivalent per hour). The 24th hour, 7 a.m., is critical because it has the highest snowfall rate (0.23 inches of water equivalent per hour).

With reference to equations in the Appendix, calculations have been made of the magnitude of components of the boiler load at the two critical hours, including the consequent losses which have been described. These values are shown in Table 3.

It is interesting to note that the difference in the fluid temperature for the 10 p.m. and the 7 a.m. conditions is only 0.8F. At first glance one might say that there is no need to consider the four component energy

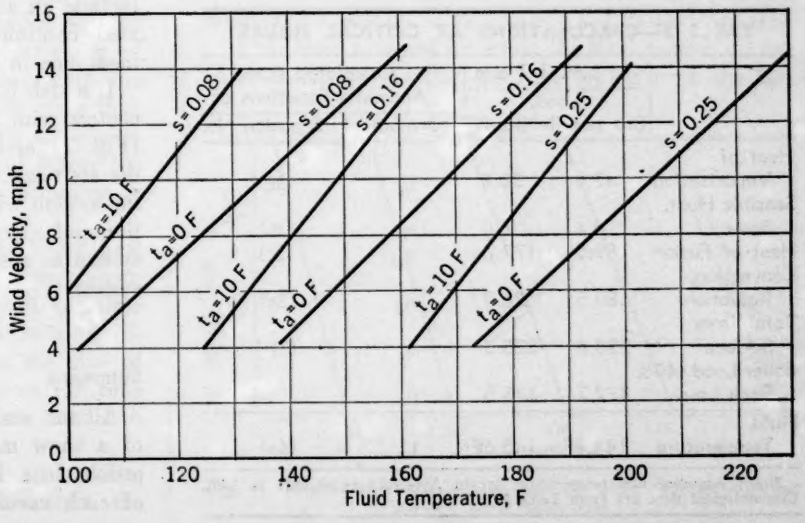


Fig. 1. Effect of wind velocity on fluid temperature for various rates of snowfall, $s$, with air temperature, $t_a$, at 0F or 10F, 90% R.H.

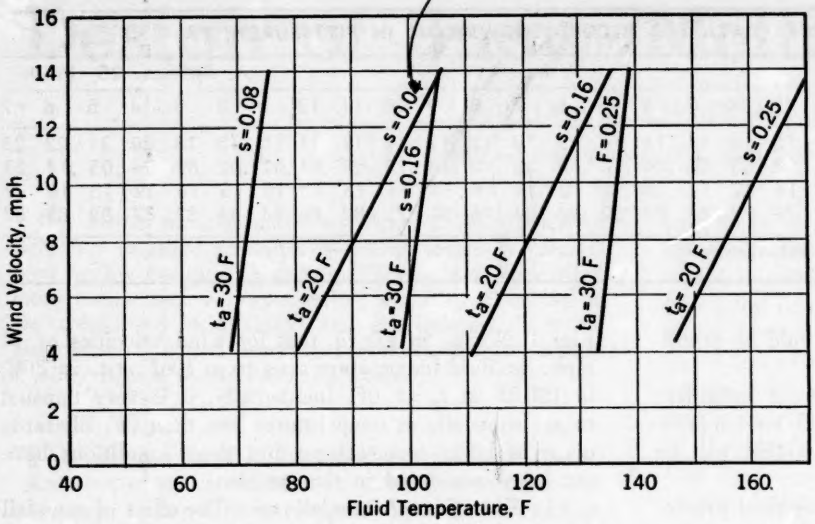


Fig. 2. Effect of wind velocity on fluid temperature for various rates of snowfall, s, with air temperature, $t_a$, at 30F or 20F, 90% R.H.

terms $q_e$, $q_m$, $q_s$ and $q_h$; the answer comes out the same either way. Actually, though, the temperatures are nearly equal *because* the four terms were considered. If the heat of fusion only were considered—the usual procedure —then the fluid temperatures would have been 78F and 119F and the outputs 89.5 and 171.6 Btu per (hr) (sq ft) for the 10 p.m. and 7 a.m. conditions respectively.

The 10 p.m. condition illustrates the difference in boiler loads that can be expected in climates with high and low temperature snowfall. It seems logical that a snow melting system in Minneapolis, Minn. would have a larger boiler than a snow melting system in Asheville, N. C., yet data on rates of snowfall would not indicate any difference. Even worse, if the designer allows for a lighter weight snow at low temperature, then he might expect the boiler in Asheville to be larger than the boiler in Minneapolis.

## Use of Design Graphs

Normally a designer would use round numbers for his climatological data. For Pittsburgh a snowfall rate of 0.08 would probably be used (see Table 1). Even for the record storm of November 24th a rate of 0.08 would cover ⅔ of the hourly readings (see Table 2).

**TABLE 3—CALCULATIONS AT CRITICAL HOURS**

| | 10 p.m. Load, Btu per (hr)(sq ft) | 7 a.m. Load, Btu per (hr)(sq ft) | Calculated from Appendix Equations as Symbol | in Equation No. |
|---|---|---|---|---|
| Heat of Vaporization | 47.0 | 20.8 | $q_e$ | (3a) |
| Sensible Heat, Snow | 6.6 | 6.0 | $q_s$ | (3b) |
| Heat of Fusion | 89.5 | 171.6 | $q_m$ | (3c) |
| Convection, Radiation | 80.5 | 26.9 | $q_h$ | (3d) |
| Total from Surface | 223.6 | 225.3 | $q_o$ | (3) |
| Boiler Load (40% Back Loss) | 372.7 | 375.5 | $q_t$ | |
| Fluid Temperature | 144.8F | 145.6F | $t_w$ | (4a) |

Note: Assumed film temperature ($t_f$ in Appendix equations) is 33F. Climatological data are from Table 2.

Assume that the design data were taken as follows:
$t_a$ = 20F (ambient air temperature)
relative humidity = 90%
s = 0.08 inches of water equivalent per hour
v = 14 mph (wind velocity)
$t_f$ = 33F (water film temperature at slab surface)
Then from Fig. 8, it can be seen that
$t_w$ = 106F (fluid temperature)
and from Appendix equation (2a) showing
$q_o = 2\ (t_w - t_f)$
$q_o$ = 146 Btu per (hr) (sq ft)
Where $q_o$ is the heat output off the surface of the slab.
With an allowance of 40% for back losses to the ground below, the boiler would be sized for 242 Btu per (hr) (sq ft).

Fig. 1 and 2 are based on equation (4a) of the Appendix.

100 − 40 = 60 $\frac{146}{.60} \simeq 242$

## Discussion

There is no consideration given here to hydraulic calculations nor to the type of fluid to be circulated in the coils. Data are available in the literature (11) giving the effects of anti-freeze on pipe friction data, so that subject need not be treated here. It is good practice to include an anti-freeze even if the system is to be operated continuously. The anti-freeze provides low cost insurance in the event of failure.

If a slab is constructed of ¾-inch steel pipe on 12-inch centers with 2 inches of concrete cover over the pipe, (Fig. 7) and the circulating fluid is kept warm when the air temperature approaches freezing, the time lag of the system will not be objectionable. With this construction and operation, it is possible to design a snow melting system as easily and rapidly as it is to design a heating system.

## Summary

All the variables necessary for the complete analysis of a snow melting system have been discussed in this article. In order to determine the magnitude of the effect of each variable on the performance of the system, it

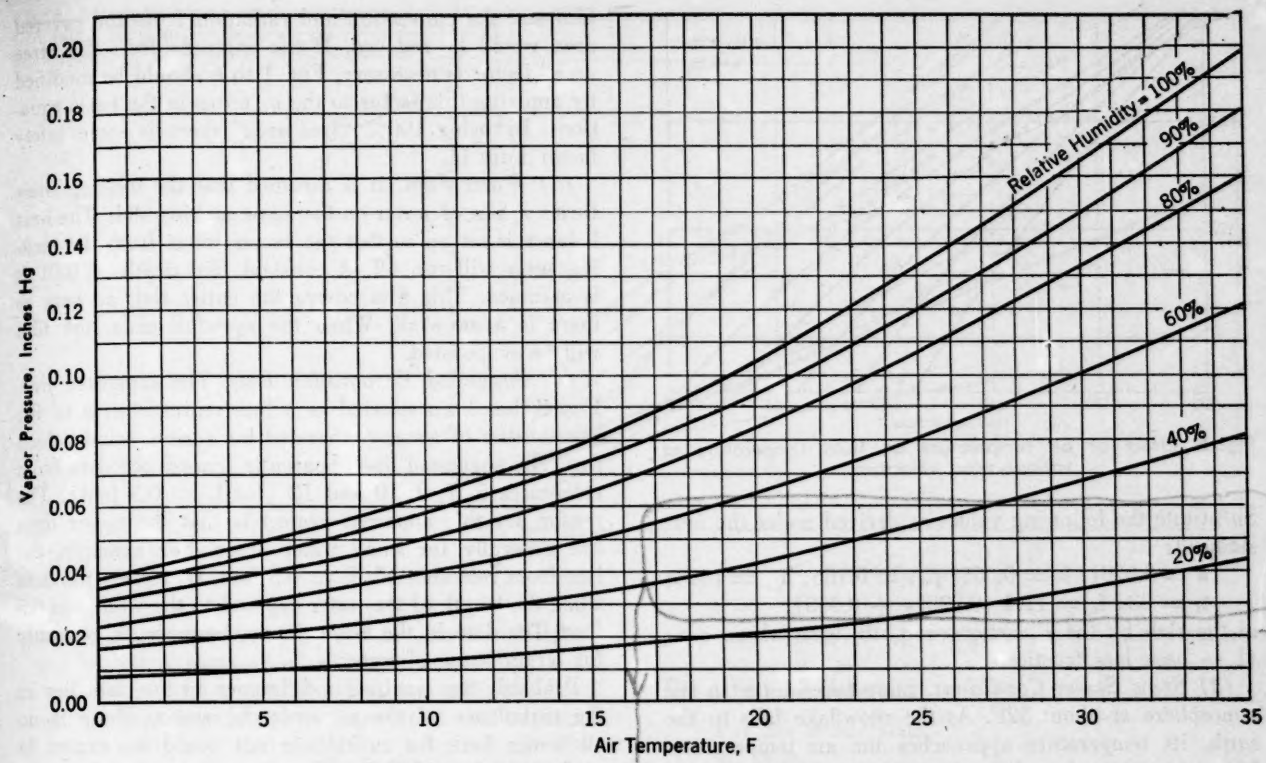


Fig. 3. Vapor pressure of moist air at various air temperatures.

is necessary to obtain climatic conditions. Obviously such data cannot be published in a magazine article, but the procedure for using the data can. Once the designer has obtained the climatic conditions to be expected for design conditions, he can then turn to the graphs or equations presented in this article and size the equipment for the system.

## APPENDIX

### Assumptions

*(1) Steady State Conditions.* All the heat transfer calculations necessary to determine the size of the heating plant for a building are based on steady state conditions. Such a procedure is conservative and quick. In the case of a snow melting system, steady state conditions are not necessarily conservative, but they are quick. The calculations will be conservative in that the boiler will be large enough, but the danger lies in the time lag of the system. For example, the designer may want the system to prevent accumulation of snow for more than one hour. If the system starts when the first snowflakes fall on the slab, and it is an hour and a half before the slab is clear, then this would not be a conservative design.

The rigorous derivation would include transient heat loss calculations. Unfortunately, the design of the system using such a procedure would be very difficult and time consuming. Since an assumption of steady state conditions will be conservative with respect to the size of the heating equipment, it is easier to correct for time lag with construction or operation allowances, than with calculation procedure.

If the pipe is kept near the surface and close together, as shown in Fig. 7, time lag will be minimized. If the system starts when the air temperature drops to freezing and a warm fluid is circulated, it is not likely the time lag will be serious. We are saying then that heat loss calculations based on steady state conditions will be sufficiently accurate if the panel is constructed properly and given a running-start in operation.

*(2) Back Loss.* Back loss is defined here as the heat transfer from the circulating fluid to the ground beneath the slab. The analysis used to determine the back loss for a radiant heating slab to the ground is the analysis that would be used in determining the back loss from the snow melting slab to the ground. If the snow melting system is operated intermittently, back losses may be in the neighborhood of 30 to 50%, depending upon insulation. If the snow melting system is operated continuously—at partial loads when the snow is not falling—the instantaneous back losses will be reduced, but would probably be as high as 30% if the slab is not insulated.

It has been assumed here that the total output, $q_t$, can be evaluated by dividing the heat output from the face

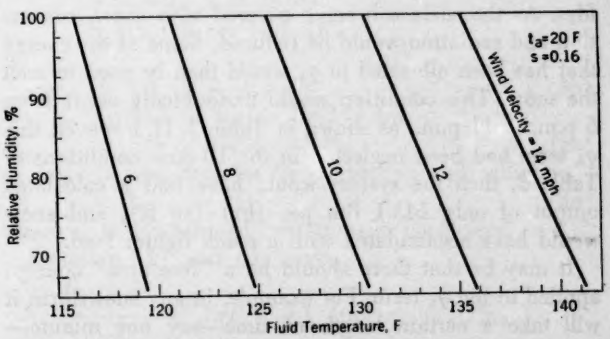


Fig. 4. Effect of relative humidity on fluid temperature at various wind velocities.

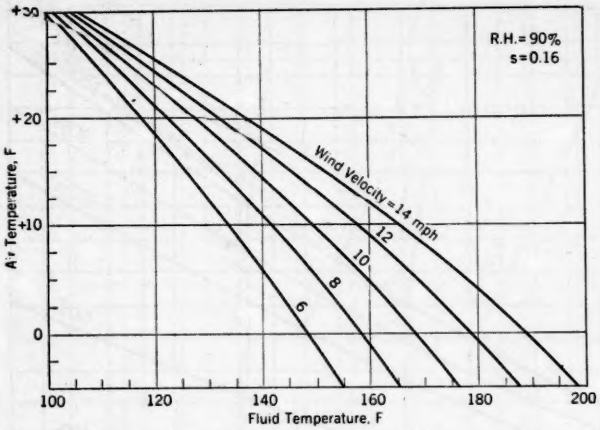


Fig. 5. Effect of air temperature on fluid temperature at various wind velocities.

Substitute the following values as derived under the next subhead:

$a = 0.0201$; $b = 0.055$; $p_{wv} = 0.185$; $h_{fg} = 1074$; $t_f = 33$; $f_c = 11.4\ (0.0201v + 0.055)$.

of the slab by the efficiency or $q_t = q_o/e$ where $e$ = (1 — back loss fraction).

*(3) Snow Storm Conditions.* Snowflakes form in the atmosphere at about 32F. As the snowflake falls to the earth, its temperature approaches the air temperature. Invariably, there is a difference in air temperature from the earth surface to the altitude where the snowflake forms, but even so, the temperature of the snowflake approaches quite closely the temperature of the air at the surface. In this article, it has been assumed that the temperature of the snow equals the temperature of the air.

Except for light snow flurries, substantial winds accompany snowfall. The top six or seven snowstorms in each year will be accompanied by wind velocities from 10 to 15 mph. The designer, therefore, should contact a local weather bureau for data on wind velocities during snowstorms. The designer should not use average seasonal wind velocity data.

*(4) Heat Transfer (Convection and Radiation).* The convection and radiation losses from the water film to the ambient air and surfaces can be considered a safety factor. For example, in the 10 p.m. conditions, shown in Table 3, there are 80.5 Btu per (hr) (sq ft) being convected or radiated. The total output from the surface was 223.6 Btu per (hr) (sq ft). If the system were designed for a total surface output of 223.6 and the load were increased, then snow would start to accumulate on the film. As the surface became covered with snow, convection and radiation would be reduced. Some of the energy that has been allocated to $q_h$ would then be used to melt the snow. This condition would undoubtedly occur from 5 p.m. to 11 p.m., as shown in Table 2. If, however, this $q_h$ term had been neglected in the 10 p.m. conditions of Table 3, then the system would have had a calculated output of only 143.1 Btu per (hr) (sq ft), and snow would have accumulated with a much lighter load.

It may be that there should be a "free area" concept applied to the $q_h$ term. For example, in any snowstorm it will take a certain length of time—say one minute—for the snowflakes to melt. During this time there may be an insulating effect caused by the snowflakes on the film and the convection and radiation from the covered area would be reduced. If the engineer feels the "free area" factor is necessary, Fig. 1 to 6 should be modified by applying this factor to the $q_h$ terms in the basic equations. By using 100% "free area" there is some safety factor built in.

*(5) Water Film.* It is assumed that the melting snow forms a film of water on the snow melting slab. The heat balance is set up so that the excess water from the melting snow will run off. A constant film depth of 0.01 ft is assumed. This film covers the entire slab as long as there is a snowfall. When the snowfall ends, the film will be evaporated.

*(6) Suggested Evaporation Rate.* The suggested line, Fig. 8, has been selected as a line representative of the relationship of water evaporated for various wind velocities. The suggested line apparently ignores the data from references 5, 7, 9, 10 and 12 (for L = 0.5 foot). The reason for this apparent neglect is that the upper lines are generally for small water areas. For example, the line from reference 12, L = 0.5 foot, represents the data when the length of the water exposed to the wind was 0.5 foot. The data in the lower group, however, is generally for larger areas of water.

Probably the significant difference in the data lies in the turbulence of the air over the water. There is no allowance here for turbulence nor could we expect to apply any data if they were given. Take, for example, a snow melting system for a sidewalk. If the wind is blowing down the street, that is parallel to the sidewalk,

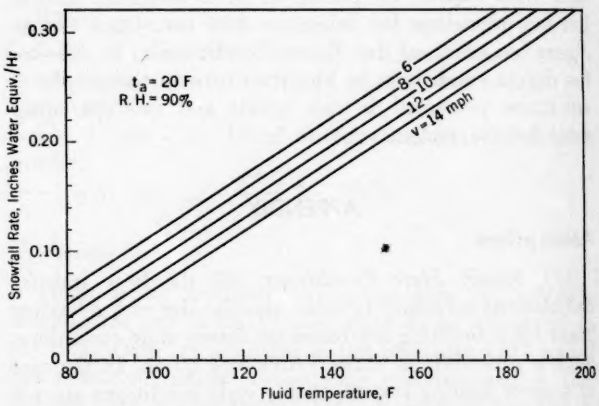


Fig. 6. Effect of snowfall rate on fluid temperature at various wind velocities, $t_a$ = + 20F at 90% R.H.

the effect of parked automobiles, fire hydrants, telephone poles, trash cans or buildings would probably be slight. If, however, the wind were blowing perpendicular to the street, say coming across a vacant lot, then the effect of automobiles, fire hydrants, etc. would be appreciably greater.

Since a sidewalk can be considered as a large area, at least with respect to the references, given in the bibliography, the upper lines were ignored in determining the suggested line.

## Glossary

$f_c$ = coefficient of combined heat transfer, Btu per (hr) (sq ft) (F)

$h_{fg}$ = enthalpy of saturated vapor at film temperature, Btu per lb

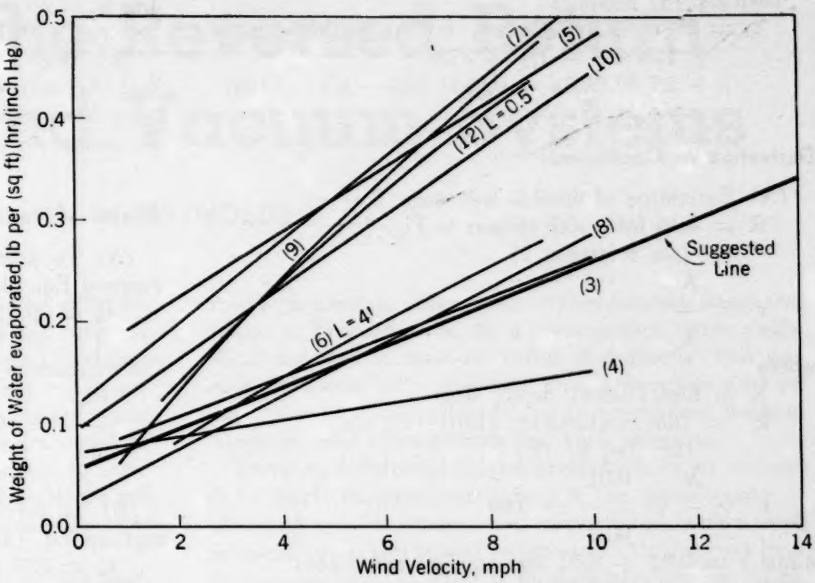


Fig. 8. Effect of wind velocity on evaporation rate. Numbers in parentheses refer to bibliography. L = length of path downwind.

$p_{av}$ = vapor pressure of moist air, inches of Hg
$p_{wv}$ = vapor pressure of water, inches of Hg
$q_e$ = heat of vaporization, Btu per (hr) (sq ft)
$q_h$ = heat transferred by convection and radiation, Btu per (hr) (sq ft)
$q_i$ = heat output, pipe to surface, Btu per (hr) (sq ft)
$q_m$ = heat of fusion, Btu per (hr) (sq ft)
$q_o$ = heat output off surface of slab, Btu per (hr) (sq ft)
$q_s$ = sensible heat to snow, Btu per (hr) (sq ft)
$q_t$ = total boiler load, Btu per (hr) (sq ft)
R = thermal resistance of panel, pipe to surface, (F) (sq ft) (hr) per Btu
r = thermal resistance, film and interface, (F) (sq ft) (hr) per Btu
s = rate of snowfall, inches of water equivalent per hour
$t_a$ = air temperature, F
$t_f$ = film (water) temperature, F
$t_w$ = fluid (water and anti-freeze solution) temperature F
v = wind velocity, mph
$w_e$ = conversion factor, for snowfall to heat requirement, Btu per (sq ft) (inch of water equivalent).

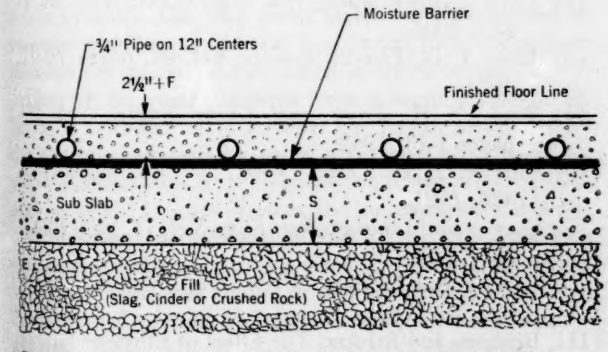


Fig. 7. Snow melting panel detail. F = Depth of finish coat—assumed as ½ inch of concrete. Finish coat may be asphalt but then cover slab should be reduced from 3 inches. Depth of slab from pipe to surface should always keep thermal resistance equal to 3 inches of concrete. S = Depth required by structural design.

## Derivation of Equations

For the steady state,

$$q_i = q_o \qquad (1)$$

where $q_i$ is heat output, pipe to surface, and $q_o$ is output from surface.

$$q_i = \frac{t_w - t_f}{R + r} \qquad (2)$$

where $t_w$ is fluid temperature in pipe; $t_f$ is film temperature; $R$ and $r$ are resistances described in glossary.

For slab construction as shown in Fig. 7, where R = 0.46 and r = 0.04 (see reference 1 and derivation under the next subhead),

$$q_i = \frac{t_w - t_f}{0.50} = q_o \qquad (2a)$$

$$q_o = q_e + q_s + q_m + q_h \qquad (3)$$

$$q_e = \text{heat of vaporization} = (av + b)\ (p_{wv} - p_{av})\ h_{fg} \qquad (3a)$$

Where $a$ and $b$ are empirical constants derived from Fig. 8, and other terms are as given in the glossary.

$q_s$ = sensible heat = $mc_i\ (t_f - t_a)$

where

m = 5.2s, lb snow per (sq ft) (hr)
s = snowfall rate, inches of water equivalent per hr
$c_i$ = specific heat of ice = 0.5 Btu per (lb) (F)

so

$$q_s = 2.6\ (t_f - t_a)\ s \qquad (3b)$$

$$q_m = \text{heat of fusion} = 143.4m = 5.2s \times 143.4 = 746s \qquad (3c)$$

$$q_h = \text{heat transfer by convection and radiation} = f_c\ (t_f - t_a) \qquad (3d)$$

where $f_c$ is a combined heat transfer coefficient.

Equating (1) and (3) gives

$$\frac{t_w - t_f}{0.50} = (av + b)\ (p_{wv} - p_{av})\ h_{fg} + 2.6s\ (t_f - t_a) + 746s + f_c\ (t_f - t_a) \qquad (4)$$

Then Eq. (4) becomes

$$t_w = 33 + 537\ (0.0201v + 0.055)\ (0.185 - p_{av}) + 1.3s\ (33 - t_a) + 373s + 5.7\ (0.0201v + 0.055)\ (33 - t_a) \qquad (4a)$$

## Derivation of Coefficients

(A) Derivation of thermal resistance, R + r:

R = 0.46 for a slab similar to Fig. 7 (see reference 1)

$$r = \frac{X}{k}$$

where

X = film (water) depth, feet.

k = film conductivity, (Btu) (ft) per (hr) (sq ft) (F)

$$r = \frac{X}{k} = \frac{0.01}{0.33} = 0.03$$

Allow r = 0.03 + 0.01 for interface resistance.

R + r = 0.46 + 0.04 = 0.50

(B) Derivation of parameter (av + b) for evaporation of water film to air: The equation of the suggested line on Fig. 8 is

$$W = (av + b)\ \triangle p_v = (0.0201v + 0.055)\ \triangle p_v$$

Therefore

a = 0.0201

b = 0.055

(C) Derivation of coefficient of combined heat transfer, $f_c$: An equation for evaporation is

$$W = K\ (H_w - H_a) \qquad (5)$$

where

W = weight of evaporated water, pounds

K = coefficient of evaporation, lb dry air per (hr) (sq ft)

$H_w$ = humidity ratio at saturation, lb water per lb dry air

$H_a$ = humidity ratio at given humidity, lb water per lb dry air

Another equation (see reference 2) is

$$Kc_p = f_c \qquad (6)$$

where $c_p$ = specific heat for air = 0.24 Btu per (lb) (F)

But from (B) above

$$W = (0.0201v + 0.055)\ (p_{wv} - p_{av}) \qquad (7)$$

Equating (5) and (7) gives

$$K = \frac{(0.0201v + 0.055)\ (p_{wv} - p_{av})}{H_w - H_a}$$

But from the definitions of the terms,

$$\frac{p_{wv} - p_{av}}{H_w - H_a} = 47.6$$

Therefore

$$K = (0.0201v + 0.055)\ 47.6 \qquad (8)$$

Then from Eq. (6)

$$f_c = 11.4\ (0.0201v + 0.055) \qquad (9)$$

(D) Derivation of vapor pressure terms, $p_{wv}$: Since $p_{wv}$ depends on $t_f$ it is necessary to set up an equation, $p_{wv} = f\ (t_f)$, for the range $32 \leq t_f \leq 35$, as, from the saturation line in Fig. 3,

$$p_{wv} = 0.0083\ t_f - 0.089$$

For $t_f = 33$, where operating costs are at a minimum,

$p_{wv} = 0.185$ inch $H_g$

(E) Derivation of the latent heat of vaporization term, $h_{fg}$: Actually $h_{fg}$ will vary slightly with $t_f$ but with $t_f = 33$, a constant value of $h_{fg} = 1074$ Btu per lb will be used.

## Effects of Variables on Fluid Temperature

(A) To determine the effect of wind velocity on $t_w$, regroup Eq. (4a) to get

$$t_w = (0.0201v + 0.055)\ (537\ [0.185 - p_{av}] + 5.7\ [33 - t_a]) + B$$

Differentiate to get

$$\frac{dt_w}{dv} = 10.8\ (0.185 - p_{av}) + 0.115\ (33 - t_a) \qquad (4b)$$

(B) To determine the effect of vapor pressure on $t_w$, regroup Eq. (4a) to get

$$t_w = 537\ (0.0201v + 0.055)\ (0.185 - p_{av}) + C$$

Differentiate to get

$$\frac{dt_w}{dp_{av}} = -537\ (0.0201v + 0.055) \qquad (4c)$$

(C) To determine the effect of snowfall rate on $t_w$, regroup Eq. (4a) to get

$$t_w = s\ (416 - 1.3\ t_a) + D$$

Differentiate to get

$$\frac{dt_w}{ds} = 416 - 1.3\ t_a \qquad (4d)$$

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# Value of the Reversed Return in Vapor and Vacuum Systems

T. W. REYNOLDS

A CORRESPONDENT raises an interesting question concerning what is commonly termed the reversed return. A reversed return is for the purpose of putting the radiators on an equal basis by balancing conditions to each. It provides the same length of flow for hot water or for steam, air and condensate from boiler outlet to boiler or return pump inlet. Resistance to flow to serve each radiator is then the same. Use of this type return has been gradually extended to vapor and vacuum systems where it offers no practical advantage.

He writes, "It has always been the policy of our engineering office to use a reversed return for vapor and vacuum systems, that is, the first radiator supplied is the last returned to obtain better balance and distribution. However, of late, a number of contractors in this area have questioned its need in the mentioned systems. They object to the additional pipe required in many installations, and they also point out that in such systems, the return mains become more or less of an extended receiver, because the thermostatic traps close off and only discharge periodically to the return mains. Therefore, they say, the reversed return loses its practicability."

### Reversed Return Still Used

Many engineers still use the reversed return and so did I not so long ago. Perhaps this was due to the example set by manufacturers of vapor specialties who laid out their own plans with reversed returns and so illustrated them in their catalogs. Even now some of their illustrations seem not to have changed. Pointing this out to a manufacturer's engineer, he answered, although indirectly, by saying, "I have never had any difficulty with any system I have designed due to the use of a direct return and I have never used a reversed return." As for myself, I would say that the use of a reversed return originated due to troubles in hot water systems and old fashioned two-pipe steam systems. The idea seems to have been extended to vacuum systems, possibly because earlier traps and poorer installations occasioned so much short circuiting.

Gravity hot water systems have a slight motive head, hence it is desirable to equalize the length of circuits to the various radiators by using a reversed return. This is also desirable with forced circulation of hot water in two-pipe systems. In such systems, the increased available circulating head permits design for higher velocities with consequent reduction in pipe sizes. The heating up period is thereby shortened and control of circulation facilitated. Pressure differentials at first radiators served are then the greatest.

The reversed return was also desirable in the old time 2-pipe steam systems having check valves and no traps at radiators and therefore steam in the returns. Due to conditions, pressures and pressure drops were high. Therefore high pressure differentials existed between steam and return at first radiators. As a consequence, steam easily short circuited to close air valves prematurely. This was most evidenced with pipe coils until a trap was used on each pipe of a long pipe coil, as in greenhouse heating. Traps reduced short circuits and back pressures.

Pressure differential is not great in a vapor system. It is nearly the same throughout if the vapor system is designed as it should be—well proportioned, with a small pressure drop, and liberal return sizes. Air does not have to be compressed to drive it through pin hole air valves. In a vacuum system pressure differential is higher.

### Advantage in a Vacuum System

Theoretically, any advantage of a reversed return in a vacuum system increases as the system becomes extensive, or in cases where it is poorly designed, installed or maintained; where it uses thermostatic elements which do not close tightly, or for cases where unreasonably high pressure differentials are set up by carrying a high steam pressure or vacuum. The bellows type of element closes tightly and remains so. Furthermore, if an element is located in the pressure and temperature range of the return, it can be affected by back pressure.

In the case of hot water the heat transfer fluid is the same from the boiler through the system and back again. In the case of modern steam heating, the conditions in the return are entirely different from those in the steam supply. One can argue to the contrary, due to possible short circuiting of steam by traps, particularly as they age. If all traps pass steam we are then back to the old fashioned two-pipe system, but the remedy is then maintenance or adjustment, new traps, or a different make or type of trap. Even with a reversed return there can never be full equalization throughout a steam system, particularly when started up, due to abnormal pressure drop from natural condensation.

Who knows which particular trap or traps of a heating system will short circuit? If it is the one nearest the boiler, it might affect the operation of those farther away were a direct return used. On the other hand, if it is one farthest from the boiler, it might affect the operation of those nearest the boiler were a reversed return used.

Thermostatic elements are filled with a liquid set to close the discharge port of a trap at say 10F below steam temperature. The element is self adjusting for various steam pressures or steam temperatures; hence, nearest traps pass slightly higher condensate into a direct return at the point of highest vacuum. The differential at this point across the trap is slightly higher so the nearest trap will more quickly discharge because of its greater capacity. Theoretically, there should be some small amount of

(*Continued on page* 144)

# Water and Plumbing Systems for a Modern Industrial Plant

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**Part 2 of a two-part article that is planned to show the steps necessary in design to insure an ample water supply at the proper pressure for industrial plants. It discusses water for sanitary systems and special drinking water facilities. Part I appears in the previous issue.**

THE instantaneous water requirements for the sanitary facilities in a building are subject to wide fluctuations, not only because of the many possible combinations of fixtures which may be in simultaneous use, but also due to the varying degree to which faucets supplying these fixtures may be opened. The water pressure in the system will constantly change due to the demand for water from other equipment and services and this will further affect the delivery to the sanitary facilities.

The elevation and physical arrangement of the fixtures, and the age and condition of the pipe, valves and fittings in the supply system, will also influence the actual delivery of water to the faucets.

Computations for water requirements are, therefore, generally based on tables of requirements for individual fixtures which allow reasonable time for filling these units, and reduction factors on these allowances per fixture when there are two or more fixtures. These reduction factors are arbitrary and are based on the experience and judgment of engineers and contractors who have had extensive experience in this class of work.

**TABLE 1—WATER DEMAND OF PLUMBING FIXTURES**

| Fixture | Water Demand, Gpm |
|---|---|
| Lavatory | 4 |
| Wash fountain | 5 |
| Wash sink | 4 |
| Service sink | 15 |
| Shower bath | 5 |
| Drinking fountains | 1 |
| Water closet with 1 inch flush valve | 30 |
| Water closet with low tank | 5 |
| Urinal with 1 inch flush valve | 30 |
| Urinal with ¾ inch flush valve | 25 |

**TABLE 3—DEMAND FACTOR FOR SCATTERED AREAS**

| Number of groups of fixtures | 2 | 3 | 4 | 5 or more |
|---|---|---|---|---|
| Factor | 0.8 | 0.7 | 0.6 | 0.5 |

Table 1 lists commonly accepted quantities of water required per individual fixture normally in use in industrial buildings.

For groups of fixtures in simultaneous operation the water requirements are given in Table 2.

If there are two or more groups of fixtures located on various floors or scattered areas in the building, the total demand on the system will be modified in accordance with the figures given in Table 3.

The fixtures and water requirements for Building A are therefore computed as follows:

Tower area 6th floor, gr. 580 ft

| | | |
|---|---|---|
| 1 Water closet with 1 inch flush valve | 30 | Allow 30 gpm |
| 1 Lavatory (probably not in use at same time as closet | 5 | |

Main building, 4th floor, gr. 550 ft

| | | |
|---|---|---|
| 2 Water closets with 1 inch flush valves | 50 | Allow 50 gpm |
| 2 Lavatories (not used at same time as water closet) | 8 | |

Tower area, 3rd floor, gr. 535 ft

| | | |
|---|---|---|
| 2 Water closets with 1 inch flush valves | 50 | Allow 70 gpm |
| 1 Urinal with ¾ inch flush valve | 25 | |
| 2 Lavatories | 8 | |

**TABLE 2—WATER DEMAND FOR GROUPS OF FIXTURES**

| Fixtures | Number of Fixtures | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 4 | 8 | 12 | 16 | 24 | 32 | 40 |
| | Water Demand, Gpm | | | | | | | | |
| Water closets and urinals with 1 inch flush valves | 30 | 50 | 80 | 120 | 140 | 160 | 200 | 250 | 300 |
| Urinals with ¾ inch flush valves | 25 | 37 | 45 | 75 | 85 | 100 | 125 | 150 | 175 |
| Lavatories and wash sinks | 4 | 8 | 12 | 24 | 30 | 40 | 48 | 64 | 75 |
| Shower baths and wash fountains | 5 | 10 | 20 | 40 | 60 | 80 | 120 | 160 | 200 |
| Service sinks | 15 | 25 | 40 | 64 | 84 | 96 | 120 | 150 | 200 |

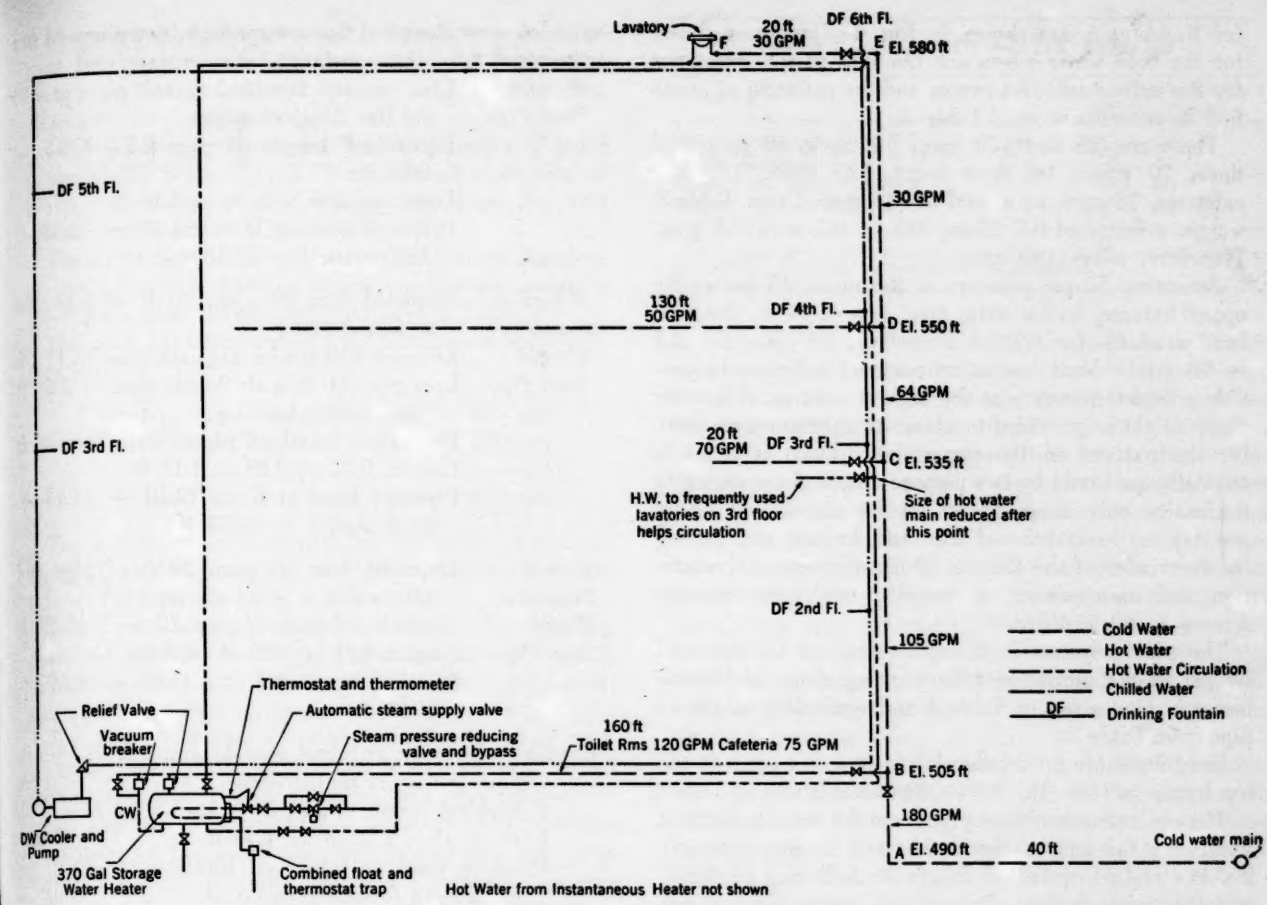


Fig. 1. Hot, cold and chilled water distribution systems for Building A. Elevation drawing shows length of pipe at various points and also the water flow.

Main building, 1st floor, gr. 505 ft

| | | |
|---|---|---|
| 4 Water closets with 1 inch flush valves | 80 | Allow 120 gpm |
| 2 Urinals with ¾ inch flush valves | 37 | |
| 6 Lavatories | 18 | |
| 4 Showers | 20 | |

Cafeteria

| | | |
|---|---|---|
| Dishwasher | 45 | Allow 75 gpm |
| 2 Sinks | 30 | |

If there were six water closets instead of four water closets and two urinals, an allowance of between 90 and 100 gpm would be adequate in accordance with Table 2. As urinals require less water than water closets, an allowance of 90 gpm should therefore be adequate for the four water closets and two urinals. Similarly, on the basis of judgment, the additional allowance of 38 gpm for the six lavatories and four showers may be reduced to 30 gpm, and a total of 120 gpm allowed for the toilet room.

Short branch connections to individual fixtures or to groups of fixtures in a toilet room may be sized on the basis of a pressure drop of not more than 30 psi per 100 ft, and long branch supplies and mains at pressure drops which will insure a pressure of not less than 15 psi at the highest and most distant fixture under maximum design flow conditions in the main and branch piping.

The hot, cold and chilled water distribution systems

**TABLE 4—FRICTION LOSSES IN PIPE, C=100**

| Flow, Gpm | Head Loss, Ft Per 100 Ft, Length | Flow, Gpm | Head Loss, Ft Per 100 Ft, Length |
|---|---|---|---|
| | 4-Inch Cast Iron Pipe | | |
| 160 | 2.93 | 180 | 3.64 |
| 170 | 3.28 | 190 | 4.03 |
| | 3-Inch Cast Iron Pipe | | |
| 160 | 11.9 | 180 | 14.8 |
| 170 | 13.35 | 190 | 16.4 |
| | 3-Inch Standard Weight Steel Pipe | | |
| 95 | 4.06 | 105 | 4.90 |
| 100 | 4.47 | 110 | 5.33 |
| | 2½-Inch Standard Weight Steel Pipe | | |
| 55 | 4.24 | 65 | 5.79 |
| 60 | 4.99 | 70 | 6.64 |
| | 2-Inch Standard Weight Steel Pipe | | |
| 26 | 2.52 | 30 | 3.29 |
| 28 | 2.89 | 35 | 4.37 |
| | 1½-Inch Standard Weight Steel Pipe | | |
| 26 | 8.51 | 30 | 11.1 |
| 28 | 9.76 | 32 | 12.5 |
| | ½-Inch Standard Weight Steel Pipe | | |
| 3.0 | 16.0 | 4.0 | 27.3 |
| 3.5 | 21.3 | 4.5 | 33.9 |

Table from Cameron Hydraulic Data.

for Building A are shown in Fig. 1. Quantities shown for the cold water risers are the sum of the quantities for the individual toilet rooms and the cafeteria as modified in accordance with Table 3.

These are 6th floor, 30 gpm; 4th floor, 50 gpm; 3rd floor, 70 gpm; 1st floor toilet, 120 gpm; 1st floor cafeteria, 75 gpm, or a total of 345 gpm. From Table 3, we get a factor of 0.5. Then, 345 × 0.5 = 172.5 gpm. Therefore, allow 180 gpm.

Assuming 50 psi pressure at the main, 15 psi at the upper fixtures, and a static head loss of 90 ft, the total head available for friction losses will be (50—15) 2.3 — 90 (static head) or an amount not sufficient to provide adequate pressure at the highest fixtures. A booster pump might be provided to obtain the necessary pressure for the fixtures on the upper floors but this toilet is normally used only by two persons and as the pressure in the mains only drops to 50 psi for about four hours per day in the months of July and August, and during the remainder of the time is 60 psi, the cost of installation and maintenance of pumping equipment for the service is not justified.

The piping system is therefore sized on the basis of 60 psi in the mains as follows using data on friction losses in pipe given in Table 4 and equivalent length of pipe from Table 5:

Head available for friction losses from the main to the top fixture is (60—15) 2.3 — 90 (static head) = 13.5 ft

The equivalent length of pipe from the main to farthest fixture on the end of the top branch is approximately 200 ft (total of equivalent length for following sections) and the pressure drop through any section should not therefore exceed 6.75 ft per 100 ft.

The size of the pipe and the pressures at the various points are computed as follows:

*Main to A—Cast Iron Pipe*—Required flow 180 gpm, 40 ft of pipe and 1 standard radius elbow
Loss per 100 ft with 3 in. pipe = 14.8 ft
Loss per 100 ft with 4 in. pipe = 3.64 ft
Since allowable pressure drop is 6.7 ft per 100 ft, use 4-inch pipe
Equivalent length of pipe = 40 + 10 = 50 ft
Loss = 0.50 × 3.64 = 1.8 ft
Pressure head at A = (60 × 2.3) — 1.8 = 136.2

*A to B—Cast Iron Pipe* Required flow 180 gpm, 15 ft of pipe, one gate valve and run of tee reduced ½. Use 4-inch pipe
Equivalent length of pipe, 15 + 2 + 10 = 27 ft
Loss = 0.27 × 3.64 = 0.98 ft
Pressure head at B = 136.2 — (0.98 + 15 ft static) = 120.22 ft

*B to C—Standard Weight Steel Pipe* Required flow 105 gpm, 30 ft of pipe and run of tee reduced ½
Loss per 100 ft with 3-inch pipe = 4.90 ft Use 3-inch pipe
Equivalent length of pipe = 30 + 8 = 38 ft
Loss = 0.38 × 4.90 = 1.86 ft
Pressure head at C = 120.22 — (1.86 + 30 ft static) = 88.36 ft

*C to D—Standard Weight Steel Pipe* Required flow 64 gpm, 15 ft of pipe and run of tee reduced ¼
Loss per 100 ft with 2½-inch pipe = 5.78 ft. Use 2½-inch pipe
Equivalent length of pipe 15 + 5.5 = 20.5 ft
Loss = 0.205 × 5.78 = 1.18 ft
Pressure head at D = 88.36 — (1.18 + 15 ft static) = 72.18 ft

*D to E—Standard Weight Steel Pipe* Required flow 30 gpm, 30 ft of pipe and standard elbow
Loss per 100 ft with 1½-inch pipe = 11.1 ft
Loss per 100 ft with 2-inch pipe = 3.29 ft Use 2-inch pipe
Equivalent length of pipe 30 + 5 = 35 ft
Loss = 0.35 × 3.29 = 1.15 ft
Pressure head at E = 72.18 — (1.15 + 30 ft static) = 41.03 ft

*E to F—Standard Weight Steel Pipe* Required flow 30 gpm, 20 ft of pipe and gate valve, use 2-inch pipe
Equivalent length of pipe 20 + 1 = 21 ft
Loss = 0.21 × 3.29 = 0.69 ft
Pressure head at F = 41.03 — 0.69 = 40.34 ft

Branch to lavatory, required flow 4 gpm, 5 ft of ½-inch pipe and short radius elbow
Equivalent length of pipe 5 + 1.5 = 6.5 ft
Loss = .065 × 27.3 = 1.75 ft
Pressure head at faucet on lavatory = 40.34 — (1.75 + 3 ft static) = 35.59
Pressure at faucet = 35.59/2.3 (ft head of water per lb pressure) = 15.47 psi

The sizes of the branch connections and the pressures at the fixtures on the other floors are computed in the same manner.

The sizes of the supply connections to various fixtures commonly used in industrial plants are given in Table 6 on the next page.

### Hot Water Requirements

The hot water requirements for the sanitary facilities of an industrial building will normally be very light except for a short time on each shift. The peak demand will generally occur when employees are going off shift and will last from 15 to 30 minutes. The fixtures will be used practically continuously during this period and it

**TABLE 5—EQUIVALENT LENGTHS OF PIPE FOR VALVES AND FITTINGS**

| Fitting | Size, Inch | Equivalent Length, Ft | Fitting | Size, Inch | Equivalent Length, Ft |
|---|---|---|---|---|---|
| Standard | 4 | 10 | Long radius | 4 | 7 |
| radius | 3 | 8 | elbow | 3 | 5 |
| elbow or | 2½ | 7 | | 2½ | 4 |
| run of tee, | 2 | 5 | | 2 | 3½ |
| reduced | 1½ | 4 | | 1½ | 3 |
| one-half | ½ | 1½ | | ½ | 1 |
| Medium | 4 | 9 | Gate valve, | 4 | 2 |
| radius | 3 | 7 | wide open | 3 | 1½ |
| elbow or | 2½ | 5½ | | 2½ | 1¼ |
| run of tee, | 2 | 4 | | 2 | 1 |
| reduced | 1½ | 3½ | | | |
| one-quarter | ½ | 1¼ | | | |

is therefore desirable to store sufficient hot water to meet the requirements of this period and to provide heating surface to heat the contents of the tank from 40 to 140F in a period of about two hours.

The hot water requirements for the cafeteria, if there is one in the plant, should be considered separately as health authorities usually require that water for this service shall be available at 180F.

The water demand in gallons for the various commonly used plumbing fixtures which require hot water is given for a peak period of 20 minutes in Table 7.

The peak hot water demand for Building A will therefore be:

| | |
|---|---|
| 11 public lavatories at 15 gal | = 165 gal |
| 4 showers at 60 gal | = 240 gal |
| Total | 405 gal |

The hot water requirements for the cafeteria are not included, as a separate source of hot water at a temperature of 180F is provided for this service.

A hot water storage heater is shown in Fig. 1 having a storage capacity of 370 gal and a heating coil capable of heating 400 gal in two hours, from 40 to 140F with steam at 5 psi gage pressure.

The heater consists of a horizontal cylindrical tank 36 inches dia by 7 ft long having a removable U-shaped heating coil with copper tubes in the lower part of the tank. The use of steam at low pressure permits better regulation of the water temperature and this low pressure steam is obtained by installing a pressure reducing valve on a 40 psi line supplying steam to the kitchen.

The heater has a hot water outlet on the top, a cold water inlet, a recirculating connection and a valved drain outlet on the bottom. A pressure relief valve is provided on the top of the tank and a vacuum breaker on the cold water connection between the shut-off valve and the tank. The return connection from the heating coil is piped through a combined float and thermostatic trap to the main condensate system.

An indicating thermometer and a thermostatic element are each installed in separable socket about one-third of the distance down from the top and on the front end of the tank. The automatic valve in the steam supply is controlled by the thermostat. A shut-off valve is provided in the steam supply that leads to the automatic valve.

The hot water line from the top of the tank is so piped (see Fig. 1) that there will be no long dead end runs supplying groups of fixtures; at the highest point it feeds up to a frequently used fixture which permits the escape of air from the system.

The last fixture on the supply line is one that is frequently used which creates a flow in the system. After passing the last fixture, the pipe size is reduced and continued back to the return connection on the underside of the tank. A check valve is provided in this line to prevent reversal of flow when drawing water at any of the fixtures near the end of the line. The loop provides means for a continual gravity circulation of hot water through the system and consequently hot water is available at all of the fixtures almost immediately after the faucet is turned on.

For the cafeteria, it is necessary to supply water continuously as needed up to 180F and for this purpose an instantaneous heater is provided which has sufficient heating surface when supplied with steam at 40 psi to heat 75 gpm from 40 to 180F. There is no storage provided with this heater and the automatic valve on the steam supply is of the modulating type and is controlled by a thermostat in a separable socket on the outlet side of the heater. The water temperature regulation with this heater is not as close as for the storage type heater but it has advantages of lower first cost and that water at the required temperature can be drawn continuously as long as needed. As there is no water storage, this type of heater is not suitable for use with a circulating system and should only be used where hot water may be used in large quantities for a time, after which there is no intermittent use.

**TABLE 6—SIZE OF CONNECTIONS TO FIXTURES**

| Fixture | Supply, Inch | Runout, Inch |
|---|---|---|
| Lavatory | 3/8 | 1/2 |
| Wash fountain | 1/2 | 1/2 |
| Sink | 1/2 | 3/4 |
| Service sink | 1/2 | 3/4 |
| Shower bath | 1/2 | 3/4 |
| Drinking fountain | 3/8 | 1/2 |
| Water closet—1 inch flush valve | 1 | 1 |
| Water closet—low tank | 3/8 | 1/2 |
| Urinal—stall 3/4 inch flush valve | 3/4 | 3/4 |
| Urinal wall hung washout | 3/4 | 3/4 |
| Urinal wall hung siphon jet | 1 | 1 |
| Urinal pedestal siphon jet | 1 | 1 |

**TABLE 7—PEAK HOT WATER DEMAND**

| Fixture | Peak Demand, Gallons (20 min period) |
|---|---|
| Private lavatory | 3 |
| Public lavatory | 15 |
| 54-inch dia wash fountain | 60 |
| Shower—5-inch rainhead | 60 |

Percentage of the total demand to be stored is 90%, and two hours is the time to be allowed for heating the total demand.

## Drinking Water

For industrial plants of the hot, heavy manufacturing type such as steel mills and furnace rooms where there is very heavy muscular work and where working temperatures are extremely high, drinking water should be supplied at temperatures from 55 to 65F and approximately one gallon of water for each four persons.

For manufacturing plants such as textile mills, glass factories, paper mills, machine shops where heavy muscular work is done but where the rooms are at normal temperatures, water should be supplied at 50 to 55F and one gallon of water for each five persons will be sufficient.

For light manufacturing plants such as auto assembly plants, canneries, food processing plants, soap factories where only light physical work is done, water should be supplied at 45 to 50F and one gallon for each seven persons is adequate.

For office workers, water should be supplied at the

same temperature and one gallon per hour will be sufficient for twelve persons. These quantities include normal spillage and waste. Water requirements should be based on the maximum number of employees per shift and the coolers should be so spaced that excessive time will not be required by employees walking to and from the coolers. The average person will use the drinking fountain four times per day and the average walking rate is 300 fpm. Placing a fountain 100 ft nearer a group of fifty persons will save approximately one employe hour per 8-hour day.

Assuming there are 135 employees in Building A where only light physical work and a small amount of office work are done, the total cooled water requirements including spillage will be approximately 20 gph. Four coolers each having a cooling capacity of 6 gph would be adequate. Because most of the employees work on the third floor, two drinking fountains are provided on this floor, one near each end of the building and one per floor are provided on each of the other floors.

Individual cooling units may be provided at each of the coolers or a central cooling system and circulating loop supply system may be used. If the individual coolers are used, a one-half inch cold water connection from a nearby potable water line will be adequate for each drinking fountain. If a loop system is to be provided as shown in Fig. 1 with the piping so run that branch connections to the fountains will not exceed about 5 ft in length, the total run of pipe will be about 750 ft.

Assuming that the size of the piping used for the loop is 1¼ inches, and that it is covered with ice water thickness cork covering which has a heat gain of 0.135 Btu per lineal foot per degree temperature difference between the water and room temperature, and that the average temperature of the water is 45F and the room temperature is 95F. The heat gain will then be

$$750 \times 0.135 \times 50 = 5{,}100 \text{ Btu per hr}$$

To offset this gain with a 5F rise in the temperature of the water, then the water that must be circulated through the system becomes

$$\frac{5{,}100}{60 \text{ min} \times 8.3 \text{ (lb water per gal)} \times 5} = 2 \text{ gpm}$$

Assuming 1 gpm draw-off from each of seven drinking fountains connected to the system, the total flow would be approximately 9 gpm. This would cause a pressure drop of 2.50 ft per 100 ft of pipe or about 17.5.

If a closed cooling system is used, the circulating pump will only have to be designed to operate against this pressure head, but if an open type cooling tank is used, a relief valve should be provided on the return connection to the tank to keep the line filled when the pump is not in operation and the pump must be capable of operating against any additional head from this source.

## Cathodic Protection of Steel Placed Underground

Underground corrosion of steel pipe has been estimated to cost 600 million dollars annually in the United States according to the National Bureau of Standards' Technical News Bulletin. Efforts to reduce this toll have been stimulated since 1941 by heavy defense requirements for steel and other metals. Workers in the field have learned that underground corrosion can be greatly reduced by cathodic protection techniques, in which the structure is maintained at a suitable negative electrical potential.

A recent study by W. J. Schwerdtfeger and O. N. McDorman of the NBS corrosion study laboratory provides a better understanding of the mechanisms of this important method of inhibiting underground corrosion. The NBS study centered around laboratory determination of the optimum potential to be maintained for effective protection. By eliminating uncertainties inherent in field measurements, NBS was able to determine an optimum protective potential having a firm scientific basis. The value arrived at (—0.77 volt referred to a saturated calomel electrode) was confirmed by weight-loss measurements on electrodes maintained at the selected potential in five corrosive soils.

Normal corrosion of iron and steel underground is largely an electrolytic phenomenon. When iron is exposed to the soil, local differences in electrical potential develop at the surface of the metal, resulting in the formation of numerous small corrosion cells. This means that electric currents flow through the soil from certain areas (anodes) to areas of less negative potential (cathodes), with accompanying loss of metal from the anodes and evolution of hydrogen at the cathodes. When cathodic protection is applied, direct current from an external source is caused to flow through the soil from an auxiliary anode toward the corroding surface. This applied current causes the cathode potentials to approach the anode potentials and thus reduces the corrosion currents.

The question of the potential at which an underground structure should be maintained in order to inhibit corrosion is of considerable interest. Insufficient potential will give inadequate protection. On the other hand, maintaining a greater potential than is needed is unnecessarily costly, since this requires supplying a larger external current through the earth.

When the potential of a cathodically protected underground structure is measured in the field, an indefinite *IR* (voltage) drop is ordinarily included in the measurement. The magnitude of this drop at a given value of current naturally depends upon the conductivity of the soil and the position of the reference electrode used in making the measurement. Corrosion circuits are complex, and there is no general agreement among engineers as to where the reference electrode should be located. A measured value of —0.85 volt (referred to a standard copper-copper-sulfate electrode) is generally accepted by engineers as the optimum protective value.

Tests have confirmed the effectiveness of a —0.77 volt protective potential. Minimum value of current needed to maintain the protective potential differed with soils.

# A simple comparison of

# Dry and Wet Collection Equipment

## for airborne contaminants

LESLIE SILVERMAN

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**A concise comparison is presented of the major advantages and disadvantages of dry and wet collection equipment for airborne contaminants. It is intended to be helpful when one has to make a selection or evaluation of such equipment.**

IN attempting to solve air cleaning problems and those related to recovery of process effluents, there are many factors involved in the selection of equipment. It is not the intent of this short article to supply detailed descriptions of equipment but merely to present in simple comparison form the major advantages and disadvantages of each type of equipment. Other articles (see list of references) describe in detail several types of equipment used for recovery and control of process effluents. The tabulation presented serves as a summary of the fundamental features of dry and wet types to be borne in mind in making an overall appraisal.

### Advantages

*Dry Collection*

Recovery of material as dry product without alteration or further treatment.

Freedom from corrosion problems may result in many instances.

Less storage capacity necessary for waste. Combustible filters may be employed for radioactive wastes to reduce storage volume.

Insoluble materials greater than 0.05 $\mu$ may be collected with high efficiency and long life of equipment.

*Wet Collection*

Simultaneous collection of gases and particulates is possible.

Recovers soluble materials readily. Material may be pumped to location for reuse, concentration, or disposal.

High temperature gases rapidly cooled and washed.

Corrosive gases and mists are recovered.

### Disadvantages

*Dry Collection*

Certain products or hygroscopic materials may "cake" and cannot be removed easily.

Secondary ventilation control often required to handle product or filter. For example, exhaust from bagging machine needs ventilation hood, re-introducing dust to control system.

Replacement or removal of filters may create an exposure problem to operators.

High temperature recovery requires special refractory materials or pretreatment of filter fibers.

It cannot be used in most cases for acid or corrosive mists.

Collector can only handle gases or vapors which can be readily adsorbed or absorbed on a solid such as activated charcoal, silica gel, soda lime or soda ash.

*Wet Collectors*

Soluble particulates for recovery must be recrystallized and may become contaminated by other materials during collection.

Collector requires wet disposal, sludge ponds, tailing piles, and other units. These create a source of secondary contamination.

Insoluble product recovery requires wet filtration equipment.

Particles less than 1 $\mu$ not readily wetted in most instances.

Corrosion problems.

Liquid entrainment in effluent air stream carrying contamination.

Freezing problems present in cold weather.

### Common to Both Types of Collectors

Type collectors with low and constant resistance.

Units with operating efficiencies that approach 100 per cent.

Devices with automatic cleaning.

Equipment which will operate either wet or dry.

Neither kind can remove rare or non-adsorbable gases without low temperature refrigerants such as liquid nitrogen.

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(3) (a) Symposium on Atmospheric Contamination and Purification, *Industrial and Engineering Chemistry,* Vol. 41 pp 2384-2493, November 1949.

(b) Symposium on Dispersions in Gases. *Industrial and Engineering Chemistry,* Vol. 43, pp 1311-1380, June 1951.

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# Abstracts of Papers Presented at St. Louis Meeting

**Condensations of papers presented at the ASHVE annual convention held in St. Louis. Some of the abstracts were published in the March issue.**

FIVE technical sessions were held at the annual meeting of the American Society of Heating and Ventilating Engineers held at St. Louis, Mo. An account of this convention and abstracts of some of the papers presented were published in the previous issue. A report of the symposium on The Industrial Atmosphere and abstracts of the balance of the papers follow:

### Industrial Atmosphere

The third technical session was devoted to a symposium on The Industrial Atmosphere, with W. N. Witheridge, industrial hygiene engineer, General Motors Corp. serving as moderator. Four speakers took part and this was followed by a motion picture on Principles of Exhaust Ventilation presented by K. E. Robinson and Arnet B. Epple of the University of Michigan, and J. M. Kane, chief engineer, American Air Filter Co.

In presenting the subject Integration of Process and Human Requirements, Harold A. Mosher, mechanical engineer, Eastman Kodak Co., Rochester, N. Y., stated the industrial engineer has at least six objectives to guide his design and specification of plant processes and equipment from the viewpoint of good control of atmospheric conditions:

(1) Reduction in health hazard
(2) Reduction in fire or explosion hazard
(3) Improvement in product quality
(4) Provisions of more comfortable conditions
(5) Economical recovery of materials
(6) Effective disposal of atmospheric wastes

There are vast forces in operation which tend to produce contamination of the atmosphere both inside and outside industrial plants. In some cases, because of technical or economical reasons, these forces cannot be wholly overcome. Development of new processes, new methods, and ingenuity on the part of engineers, are necessary in this area. In other cases, the requirements of the process and those of man are virtually the same, and the arrangements can approach the ideal. In the remaining areas, the process and human requirements are adverse to each other, and the engineer must devise an acceptable compromise.

It is in this latter area that the enterprising and imaginative engineer in industry can make the greatest contribution. There is much opportunity for the development and promotion of practices, all within the framework of sound business economics and policy, which provide safe, comfortable, healthful, and efficient atmospheric conditions in the industrial environment.

A. T. Waidelich and W. Hunting, Cleveland, Ohio, spoke on Effect of Atmospheric Requirements on Industrial Architecture and Plant Layout.

The viewpoint of architectural engineering is essential to the successful design of air conditioning and air pollution control systems for industrial structures. In the design of buildings to take advantage of local meteorological and climatic forces, the architectural engineer is an essential member of the team of collaborating specialists.

Mechanical control of the indoor atmosphere must be undertaken with full appreciation of the location, orientation, and design of the industrial structure for the most effective cooperation with natural forces. Space requirements and the location of mechanical equipment should be carefully coordinated with the function and appearance of the modern industrial building.

Examples of recent projects will serve to illustrate the diversity of industrial requirements, and will emphasize the need for active cooperation between management, architect, engineer, and equipment manufacturer.

R. P. Warren, Buffalo, N. Y., the third symposium speaker talked on Equipment for Industrial Ventilation and Air Pollution Control.

As a result of many years' experience in this field, he suggests that there are four essential phases in every air handling problem:

(1) Why do you have a problem?
(2) What are the limits of the problem?
(3) How can you solve it?
(4) How do you know you have solved it?

The manufacturer of equipment for industrial ventilation and air pollution control must know two important things about the atmospheric problem:

(1) What is the source or cause of difficulty?
(2) What would be a satisfactory condition?

After these two points are established, the equipment manufacturer is then in a position to recommend the best type of equipment or system to provide a satisfactory solution to the problem. And today, because of increasingly rigid regulations and more intelligent appraisal of results, it is essential that final accomplishment of the system be demonstrable.

It is evident that industrial ventilation and air pollution control are increasingly important to our industrial welfare.

Effects of the Industrial Atmosphere on Workers and on the Community was the last symposium subject. It was presented by R. A. Kehoe, M.D., Cincinnati, Ohio.

There is now a good background of information in the fields of industrial physiology, industrial toxicology, and industrial medicine on the effects of unfavorable physical and chemical conditions on the occupants of industrial plants. Effective use of this knowledge in recent years has enabled engineers to establish the effectivness of their equipment for control of the industrial environment. Medical methods of control have been coordinated with engineering methods.

Insofar as the facts relate to man, they have been estab-

lished by the clinical study of the populations of industrial plants. This has not been done extensively or adequately, but we do have a fair body of useful information.

When we come to the matter of air pollution and community health, we draw a blank, for all practical purposes. There have been accidents that have injured and killed some people here and there, notably in Belgium (Meuse Valley) and in Donora, Pa., but these are unimportant in relation to the major problem of the chronic effects, if any, of prolonged exposure to low concentrations and mixtures of low concentrations of atmospheric contaminants. There is not yet a single example of an experimental chemical, clinical, and epidemiological investigation of this problem, and thus what we know for certain is derived from the studies of this sort carried out on groups of industrial workers. We know something of the effects of individual substances and almost nothing of the combined effects of a number of substances. The facts in this field are ahead of us, and yet to be established.

It is indeed timely to consider the methods of investigation that can be applied by any professional or public group of consequence which has reached the conclusion that something needs to be done.

## A Special Problem of Venting

A simple method for venting forced circulation hot water panel heating systems was described by F. E. Giesecke, consulting engineer, New Braunfels, Tex., in his paper Venting Hot Water Heating Systems. As a result of operating an experimental heating system for two heating seasons, it was learned that the system could be properly vented by means of a vent placed in the main flow line directly above the boiler. However, air traps in such systems need not be vented if the pressure head is sufficient to force water through the traps.

Tests during the first heating season indicated that about one cubic foot of gas was vented from the boiler to the air chamber during the six-month heating season. During the first two days about 0.25 cu ft of gas was vented. This was probably the air which had been trapped when the system was filled.

As the result of operation during the two heating seasons, it was concluded that:

(1) Gases can be removed easily from a system by connecting a vent to the flow main directly above the boiler.

(2) Water circulating through the system will move gases and carry them to the boiler, if the pump produces a pressure head sufficient to force water through those parts of the system where gases are lodged.

(3) In a well constructed system, when the gases have been removed, no more gases will enter the system other than those which are transmitted through the expansion tank.

(4) In a poorly constructed system, in which leaks exist and make-up water must be supplied, the make-up water will supply additional gases to the system.

## Environment Laboratory

Facilities of the new society environment laboratory were described by Cyril Tasker, director of research; C. M. Humphreys, senior engineer; G. V. Parmelee, research associate; and L. F. Schutrum, research engineer—all of the ASHVE Research Laboratory staff— in a paper on The ASHVE Environment Laboratory.

This laboratory is located on the upper floor of the Research Laboratory which has a clear ceiling height of nearly 18 ft. The framework consists of lightweight steel members installed on 16-inch centers. The floor of this room is 3 ft above the main floor so that there is a crawl space for the installation of ducts, pipes and wiring. Maximum available ceiling height in the room is 12 ft. However to obtain a variable ceiling height, a second movable ceiling was built on a framework of angle iron and 9-inch steel joists. This was built in two halves so that when this room is partitioned in two, either part of the room may be adjusted independently of the other.

Considerable thought went into the design of the heating and cooling panels for this room so that the panels could meet basic design concepts. Fluid rates in these panels have to be much higher than required in the average panel heating or cooling installation. Panel arrangement and sizes were carefully chosen to provide maximum flexibility in selecting typical combinations of simulated glass and wall areas for various ceiling heights.

In the research laboratory, directly below this test room, are the tanks, heaters, coolers, pumps and other equipment necessary for conditioning and for circulating liquids through the various wall, floor and ceiling panels. The system contains a 22% by weight, aqueous solution of ethylene glycol plus a corrosion inhibitor. Chilled liquid is stored in a 300 gal tank. Liquid for the warm panels is heated by a gas-fired water heater and is stored in a 220 gal tank. A pump provides positive circulation through the tank and heater and good mixing in the tank.

Four centrifugal pumps and four piping circuits supply liquid at the desired conditions to the panels of the laboratory.

About 800 cfm of air is taken through a duct from the space above the adjustable ceiling and is then passed through a sorption type dehumidifier. The greater part of this air is cooled to about 70F. This cooled air is discharged into the crawl space and finds its way up through the stud spaces to the space above the adjustable ceiling. This means that all of the spaces containing piping or facing the back of the panels, including the crawl space, the spaces back of the wall panels, and that over the ceiling, have dehumidified air circulating through them.

The remainder of the dehumidified air, about 130 cfm, first passes through a precooling coil and is then given additional cooling by a direct expansion coil where temperatures down to 0 F may be obtained.

Instruments measure not only the temperatures of, and the rates of heat exchange at all surfaces of the room, but also all factors which affect heat exchange. It is possible to measure objectively those factors which are related to human comfort. Each of the six room surfaces is provided with a metal sub-panel which carries the terminal strips and the necessary selector switches. Each sub-panel is enclosed by a removable plywood housing. Heat exchange between each room surface and its environment is measured by 175 heat flow meters. There are instruments for measuring mean radiant temperature, directional mean radiant temperature and resultant temperature.

In preparing the design details for this test room, every effort was made to provide facilities that would be readily adaptable to a wide variety of uses. This room will make

possible studies on heat transfer between heated and cooled surfaces and the space they enclose.

### Isothermal Ventilation-Jet Fundamentals

A paper on Isothermal Ventilation-Jet Fundamentals was prepared by members of the ASHVE Research Laboratory staff—H. B. Nottage, research associate, and research associates J. G. Slaby and W. P. Gojsza.

As part of a long range research program, studies were conducted and as a result, data and fundamental interpretations reported for ventilation jets discharging horizontally into a large confined space.

The findings for isothermal jets are that outlet velocity has an important influence upon the variation of maximum jet velocity with distance from the outlet; that jet boundaries defined from velocity-vectory direction data are easily determined by experiment and are useful analytically; that the total rate of jet momentum flow is not constant; that cross jet velocity profiles do not fit the simple analytical functions frequently assumed; that the region of negative jet entrainment and ultimate dispersion is important in room air movement and can be dealt with quanitatively; that the shear-stress distribution within the flow region can be established from the data obtained, thereby providing a fundamental insight concerning the flow phenomena; and that the eddy viscosity can be represented by a simple empirical expression which offers a very useful means for the further development of the theory.

The authors stated that the paper was intended primarily to stimulate an appreciation of physical phenomena rather than to provide direct data that are commonly found in handbooks.

### Influence of Clothing on Environment Changes

Results of research on two groups of men to determine physiological adjustments to sudden changes in environment were reported in a paper, Physiological Adjustments of Clothed Human Beings to Sudden Change in Environment—First Hot Moist and Later Comfortable Conditions. Research was sponsored by ASHVE and the United States Public Health Service in cooperation with the University of Illinois, College of Medicine, Chicago, Ill. Authors of this paper are the following members of the University of Illinois: Dr. Ford K. Hick, professor of medicine; Tohru Inouye, research assistant, Department of Medicine; Dr. Robert W. Keeton, professor of medicine, emeritus; Maurice K. Fahnestock, professor of mechanical engineering; and Nathaniel Glickman, Chicago.

The physiological responses of seven healthy men dressed in standard summer clothing were compared with those of ten healthy young men dressed in long length union suits when subjected to sudden changes in environment.

On exposure to a hot humid environment, the subjects perspired freely so that at the end of the first hour, the moisture content averaged 490 and 220 grams for the summer clothing and union suit groups, respectively; at the end of the second hour, it was 910 and 390 grams respectively for the same groups. The rectal and skin temperatures attained slightly higher levels with the added clothing by the end of two hours.

On moving from the hot room to the comfortable environment, all subjects felt cool. The skin cooling was less rapid with the added insulation in spite of the greater amount of moisture it contained. The amount of evaporation during the hour was the same regardless of the clothing.

The men dressed in standard summer clothing withstood the sudden changes in environment readily and without evidences of strain. The adjustments were made with as much ease as by those men dressed in union suits.

### V-Wire Direction Probe

A simple type of direction measuring probe was developed for room air distribution research. This instrument was described and reported in a paper A V-Wire Direction Probe. Authors are H. B. Nottage, J. G. Slaby and W. P. Gojsza, all of the ASHVE Research Laboratory staff, Cleveland, Ohio.

This device was found suited to the lower velocity range where aero-dynamic direction probes, responding to impact pressure, become difficult to use because (1) the very small magnitude of the impact pressure, (2) the considerable time required to obtain a pressure balance with pressure lines of appreciable length and only a small pressure difference available, and (3) the fluctuations present in turbulent shear flow.

The instrument was developed for use in free streams. The velocity range covered has been from 6,000 fpm to roughly 50 fpm. In free turbulent air streams of low velocities, large scale whirls, billows and surges are encountered which make the V-wire principle impractical for tracing streamlines.

Two methods of use have been employed: (1) setting the probe in position and rotating the V to balance the galvanometer, and (2) setting the V-angle and traversing the entire probe assembly to locate the position of galvanometer balance. Convenience dictates the method that is selected.

The sensing element is a fine platinum-iridium wire in the form of a V supported on three needle points and carrying a heating current as part of a bridge circuit. In use, the V is pointed into the oncoming stream. If the V has been properly zeroed, both electrically and mechanically, the position of the bisector of the V-angle will coincide with the stream direction when the galvanometer shows zero deflection.

### Warm Air Perimeter Heating

A report of an investigation conducted in the Floor Slab Laboratory at the University of Illinois through a cooperative agreement between the National Warm Air Heating and Air Conditioning Association and the Engineering Experiment Station of the University of Illinois is presented as a paper on the general subject of warm air perimeter heating covering Temperature Drop in Ducts Embedded in Concrete Floors—Part 2. Authors are J. R. Jamieson, research associate in mechanical engineering; R. W. Roose, research assistant professor of mechanical engineering; S. Konzo, professor of mechanical engineering; and H. T. Gilkey, research assistant in mechanical engineering, all of the University of Illinois. Part 1, published last year, is titled Heat Emitted from Floor Surface.

Both the floor surface temperature distribution and the heat emission from the floor surface were studied for an embedded feeder duct connecting the furnace to the perimeter duct. Uniformity of floor surface temperatures along the feeder duct was obtained by varying the thickness of concrete between the duct and the floor surface.

In the design of a perimeter heating system, an evaluation of the temperature drop is useful for determining (1) the rate of heat flow through the duct surface to the room and to the ground, and (2) the enthalpy of the air flowing into the rooms through the various registers.

An analysis of the temperature drops between the inlet and outlet of fittings indicated that the 45 deg elbow and tee combination produced a drop equivalent to that for a 10 ft length of feeder duct. A 90 deg elbow used in a section of perimeter duct produced a temperature drop equivalent to that obtained in a 3 ft straight section of perimeter duct.

The perimeter duct, was located with its center 8 inches from the outer wall and 6 inches below the floor surface, consisted of an 8-inch diameter galvanized iron duct embedded in concrete. The feeder duct of the same diameter was attached to the perimeter duct at the exposed corner of a room with two 45 deg elbows and a tee fitting. Air flowing through the ducts was not discharged into the rooms.

The rate of heat emission from the heated floor to the room varied from 35 to 110 Btu per hour for each linear foot of feeder duct, depending primarily upon the duct air temperature.

The magnitude of the floor surface temperature over the feeder duct was dependent upon the mean duct air temperature duct air velocity and depth of feeder duct. For a given combination of duct air temperature and duct air velocity, a uniform floor surface temperature was attained by sloping the feeder duct upwards from the furnace to the tee fitting with a pitch of one inch in 5 ft. A floor surface temperature of 85F over the center of the duct was observed along its entire length when the entering duct temperature was 115F and the duct air velocity was 500 fpm. These duct air conditions are representative of those for an average winter day in Urbana, Ill. With an outdoor temperature of —10F, the floor surface temperatures were about 98F near the subfloor plenum and about 105F near the end of the feeder duct. The floor area having a surface temperature in excess of 85F was limited to strips less than 2 ft wide over the feeder duct.

Calculated values of the temperature of the floor surface directly over the center of the feeder duct were about 2.5 to 5 degrees higher than the measured values. For this calculation, the total resistance of heat flow from the duct air to room air was considered to be composed of (1) the duct air film resistance, (2) the resistance of concrete, and (3) the room air film resistance.

Based on this study, curves were developed to determine the magnitude of the temperature drops in the feeder duct as well as in the perimeter duct insulated with one and two-inch thicknesses of edge insulation.

## Heat Losses from Floor Slab

The third part of research on warm air perimeter heating was reported by J. R. Jamieson, R. W. Roose and S. Konzo, respectively research associate in mechanical engineering, research assistant professor of mechanical engineering, and professor of mechanical engineering, University of Illinois, in a paper on Heat Losses from Floor Slab. Like the previous study, this too was a cooperative investigation conducted through an agreement between the National Warm Air Heating and Air Conditioning Association and the Engineering Experiment Station of the University of Illinois.

A large portion of the subfloor heat losses occurred at the outer edge of the floor slab. Of the four types of edge construction studied, that which incorporated a two-inch thick L-type edge insulation was founded to be most effective in reducing the subfloor heat losses.

Warm air was circulated continuously through the perimeter duct at a constant entering duct air temperature and constant duct air velocity during each of a series of tests. After a given series of tests, changes were made in duct air temperature or velocity, and four days were allowed for the ground conditions to stabilize.

Heat conducted from the surfaces of the perimeter duct resulted in a heat gain into the room and heat losses through the foundation wall to the outdoor air and to the ground. The subfloor heat loss was found to be a function of duct air temperature, duct air velocity, outdoor temperature and type of edge insulation. Of the four types of edge insulation investigated, the two-inch L-type insulation produced the best results. A comparison of results for the one inch L-type insulation with the one inch vertical insulation indicated little difference in the subfloor heat losses. The uninsulated floor slab produced subfloor heat losses approximately twice as large as those for the slab with the two-inch L-type insulation. Therefore, the use of an uninsulated floor slab is not recommended for warm air perimeter heating installations.

A qualitative analysis of the various methods of applying edge insulation indicated that a two-inch thickness of edge insulation was adequate, that the application of L-type edge insulation could be improved by extending it further under the slab, and that the application of vertical edge insulation could be improved by extending it to a greater depth. Calculations indicate that the warmer floors obtained with the perimeter system would increase the total heat loss about 7% as compared with that for a conventional system.

In a supplemental study, an analysis was made of the time lags involved in the heat transfer by conduction from the perimeter duct.

## Perimeter Loop System

A third paper in this group, reported in the previous issue, is on Performance of a Warm Air Radial-Feeder Perimeter-Loop System in a Residence. The authors are M. E. Childs, research associate, R. W. Roose, research assistant professor of mechanical engineering, and S. Konzo, professor of mechnical engineering, all of the University of Illinois, Urbana, Ill.

They found that placing the registers below the window resulted in lower temperature differentials, and that the use of a large number of feeder ducts generally resulted in improved differentials since the panel heating effect was increased. However, the location of the feeder ducts was more important than the number used provided that the feeders could assure an adequate delivery of warm air to all sections of the perimeter duct.

# PRODUCT APPLICATIONS

## New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

### Packaged Unit Cools Bank

**PROBLEM:** At the West Side Federal Savings and Loan Association in New York City, an extensive alteration and modernization program included plans for a central station air conditioning system to provide cool air for 8500 square feet of banking, office, and lounge space.

**SOLUTION:** The system installed by Eugene J. Brandt Co., contractor, uses a 30-ton, dual circuit, refrigerated Kooler-Aire unit manufactured by the U. S. Air Conditioning Corp. Four supply risers carry conditioned air from a basement equipment room. Each room on the main floor has an individual return, while on the mezzanine air is returned through louvered doors. The central package includes two separate refrigeration circuits and built-in evaporative condenser.

**RESULTS:** Unit can function at full or half capacity providing economy of operation under varying air conditions.

### Packaging Material Serves as Insulator

**PROBLEM:** In the packaging of many products, the dual problem arises of protection against breakage of fragile parts and protection against heat and cold.

**SOLUTION:** When Armed Forces packaging experts wanted a cushioning material to protect delicate equipment which was to be dropped by parachute to combat troops, they chose Celluliner, a new packaging material made by The Gilman Brothers Co. in Gilman, Conn. One of the demonstrations of the properties of the product was to drop several dozen raw eggs off a 25-foot high roof one after the other onto a double thick layer of Celluliner. Not one of the eggs broke or even cracked. They merely bounced unharmed when they hit the resilient material. Another part of the demonstration showed insulating properties of the material. Lawrence Gilman, president of the company, held a one-inch thick square of flame-proofed Celluliner in the palm of his hand while one of his men directed the flame of an oxy-acetylene torch onto it.

**RESULTS:** An insulating resilient packaging material, adaptable to a variety of uses, has proved successful in military applications. By varying the manufacturing process, material can be made either highly absorbent or non-absorbent. It can be mildewproofed and flameproofed.

### Leak Detector Speeds Food Process

**PROBLEM:** At the Sherman, Texas, plant of Mrs. Tucker's Foods, Inc., more than 10,000 lbs of vegetable oil per hour undergo a deodorization process. This is the final step in a refining process which makes crude soybean and cottonseed oils suitable for use in shortening and other food products. The process depends upon a nearly absolute vacuum. If leaks allow air to enter the system, the entire unit must be shut down.

**SOLUTION:** A General Electric Type H leak detector is now being used to discover the leaks as they occur. The detector, which reacts to halogen gases, is normally used to find leaks in pressure systems. At the food plant, the probe of the detector is inserted in the vacuum system's exhaust pipe and the output of the control unit is connected to an automobile horn which sounds an alarm when a leak is present. Using a portable cylinder of Freon, the workman goes over the system, spraying it with the gas. If a leak is present, the Freon is drawn into the system and taken to the exhaust pipe where the detector is installed. The device reacts to the Freon, the horn sounds, instruments indicate the intensity of the leak, and the position of the workman shows the approximate location of the leak.

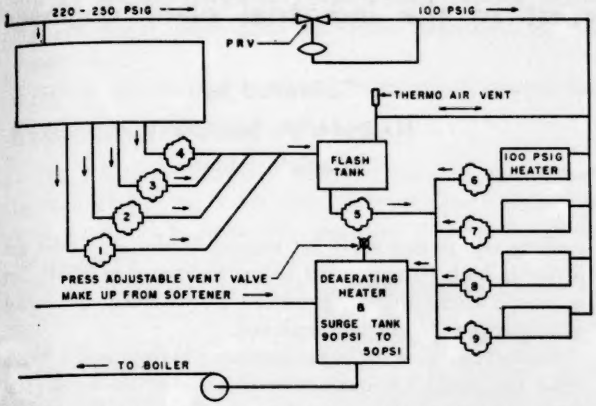
**RESULTS:** One big advantage of the detector is that the system does not have to be shut down while testing for leaks. Prior to installation of the detector, the only way of finding leaks was to shut down and apply air pressure to the vessels, and the leaks were then found by painting the suspected locations with soap solution. Now monthly checks can be made without shutting the process down.

Send in a
**PRODUCT APPLICATION**
HEATING AND VENTILATING
148 Lafayette St., New York 13, N. Y.

## High Pressure Traps Supply Heaters

**PROBLEM:** In a chemical plant it was decided to use process steam at 250 psig for heating.

**SOLUTION:** Flash steam from high pressure Armstrong traps was used to supply steam to a medium pressure heater. Flash steam, formed when traps 1 to 4 (see sketch)




discharge from 220 to 100 psig, is used by heaters operating at 100 psig. Traps discharge into a flash tank. Condensate from the flash tank and from the heaters is discharged to a deaerating heater and surge tank where the heater is maintained at a pressure from 50 to 90 psig.

**RESULTS:** Space heating is accomplished directly from mains of steam supply.

## Plastic Pipe Used in Recharging Well

**PROBLEM:** At the Timken Roller Bearing Company's Columbus, Ohio, branch, four deep wells, two supply and two return, serve a water system for several cooling processes. Each supply well is approximately 400 ft deep. Two multi-stage centrifugal deep well pumps force water through a 3,000-ft network of factory pipe lines. Pumping capacity of the two systems is 650 gpm. Used water is discharged into open cisterns before entering the return wells. The return wells, originally 400 feet deep, are located within 120 feet of supply wells. Warm water entering the return wells was finding its way into the supply and raising the temperature appreciably.

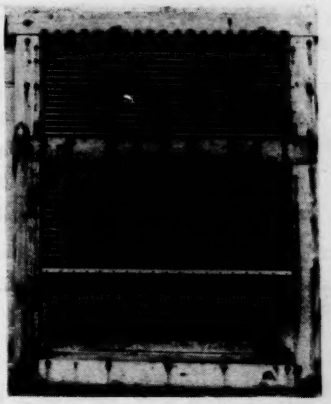
**SOLUTION:** To overcome this, the return wells were drilled to a depth of approximately 500 ft and tubed with Yardley 6-inch rigid plastic pipe to 475 feet. Plastic pipe and fittings were manufactured by Yardley Plastics Company, Columbus, Ohio.

**RESULTS:** Warm water return now enters strata below the source of supply. Installation of the plastic pipe was speedy and economical. It is believed that the pipe will withstand the corrosive properties of free hydrogen sulphide present in the water which has caused some trouble with ferrous pipe.

## Non-Freeze Cooler Protects Turkeys

**PROBLEM:** Last winter the Lincoln Trail Turkey Farm in Athens, Ill., had a serious problem when their water cooled refrigeration system froze and destroyed important equipment. Owner W. Wilson decided to make replacements with a non-freeze system to assure protection of the 11,000 turkeys that are processed yearly.

**SOLUTION:** To eliminate this freezing danger with economical automatic equip- that would maintain constant temperatures, Mr. Wilson selected the Kramer Trenton Co.'s Unicon air cooled condenser and Thermobank automatic defrost systems. Each of the two 5-hp compressors used were connected to a separate condenser. This eliminated the use of any water in the system. Pressure controls were installed to raise the head pressure by stopping the condenser fans when needed during winter operation. By the use of a simple damper arrangement, the air for the condenser can be supplied from the outside or inside. Thus the working area can be ventilated in summer at no additional cost.



**RESULTS:** By installing two complete independent 5 hp systems, automatic defrosting of one system can be accomplished while the other system is held. In the event of a breakdown of one system, the other system will prevent spoilage while repairs are being made.

## Synagogue Radiant Heated

**PROBLEM:** At the recently completed synagogue for Adas Israel Congregation in Washington, D. C., it was desired to heat the seating area, which has a ceiling 50 feet high and covers a floor space approximately 100 x 120 feet, in such a manner as to provide warmth for the feet of elderly members of the congregation who frequently occupy the building for long periods of time. Similar treatment was required in the balcony, set aside for the use of the women of the congregation.

**SOLUTION:** Radiant heating coils of A. M. Byers Co. wrought iron were laid over a 4-inch slab of water repellent insulating concrete. After the pipe was tested, a 4-inch slab of dense concrete was poured over the entire area. The radiant heating system was extended to the balcony and to a 300-seat chapel which is in use every day.

**RESULTS:** Placing the heating system in the floor has minimized convection losses to the 50 ft ceiling and the feet of elderly worshippers remain comfortable through the longest services.

# What Would You Do?

## Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

### This Month's Problem

**A new production area is to be added to our plant which calls for a quenching bath for steel. What are some of the cooling problems involved in cooling the quenching oils for such a bath? I was informed that the shell and tube heat exchanger is most economical for cooling the oil. Is this so?**

THE industrial plant engineer is faced with problems of installation, operation and maintenance that are peculiar to his special work. To help him in solving special, troublesome questions, that he may come across in his work, he is invited to submit such problems for discussion in this department. Those of general interest will be used. In addition, comments are invited regarding problems that are scheduled for discussion in future issues. In this way, the plant engineer can enjoy the benefit of specialized experience in the solution of some perplexing mechanical situation.

In the box on this page is the problem that forms the basis for this month's discussion. At the bottom of the page are the questions scheduled for the May and June issues.

### Answer to this Month's Problem

There are two distinct methods of quenching—the continuous quench method and the batch quench method. In the former, the pieces being quenched are immersed in the bath at a continuous rate. The cooling rate is, therefore, for all practical purposes, continuous and uniform. In the latter method the metal is immersed in the oil at regular or irregular intervals with a relatively long time between operations. For batch quenching the cooling capacity of the oil cooling equipment can be considerably smaller than for continuous quenching, since the intervening time between quenches can be utilized to absorb the heat from the bath.

In cooling quenching oils, the problem is principally one of the removal of heat from the quenching bath. From the standpoint of convenience, there is the additional problem of adopting a method of cooling which is sufficiently flexible to prove year-round operation and uniform bath temperatures. Where the atmospheric principle is used, precautions must be taken for protection against freezing.

It may also be necessary to provide facilities to heat the bath after periods of system shutdown, during which time the bath approaches shop temperature. If oil temperatures are too high entering the coils or other heat transfer surfaces, the possibility of liming cannot be discounted. It is recommended that the oil temperature entering the cooling equipment shall not exceed 165F. This does not prohibit bath temperatures being in excess of 165F, but in cases where this temperature is exceeded, a by-pass arrangement should be employed.

Since quenching baths are generally maintained between 100F and 150F, it is quite often possible to use a comparatively high temperature cooling medium. In the case of higher range of temperatures, there exists the possibility of utilizing water at about 100F or less. For the upper and middle range, the use of the atmospheric evaporation principle can be used. For the lower temperatures, and particularly where bath temperatures are lower than the ordinary limits indicated, low temperature sources of cooling or possibly refrigeration may be used.

In the event the cooling water supply available is satisfactory with respect to temperature, quantity, quality and cost, a shell and tube heat exchanger will undoubtedly be the most economical solution to the problem. When selecting the shell and tube heat exchanger, care should be exercised to insure that the initial economy gained by a relatively small exchanger is not lost through excessive pumping costs.

The heat exchanger method of cooling quenching oil is the simplest method to lay out, requires the least equipment, and is the most compact. However, this system does require a constant source of adequate cooling water which may be supplied from the city water mains, rivers or lakes. If city water is used, the cost should be carefully weighed

(*Continued on page* 144)

### Problems for Coming Issues

**May Issue**

**In the past we have been using cement joints when laying tile pipe. This joint does not permit settling of pipe and we have experienced some broken pipe. Hot poured compound joints have been recommended. What compound can be used? Will it prevent movement?**

**June Issue**

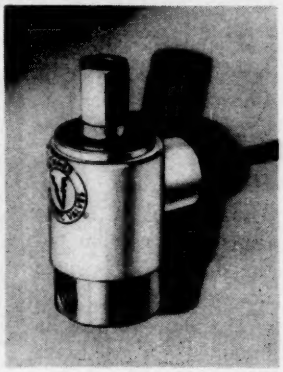
**In one part of our plant we have to exhaust mild sulfurous fumes at temperatures about 150 to 170F. Ducts back of the fan have had a short life and replacement costs mount. I am interested in what others have done to protect the metal surface or to cut down the frequency of duct replacements.**

# NEWS OF EQUIPMENT AND MATERIALS

**Use the prepaid postcard opposite Page 126 for securing additional information on items described in this department.**

## Explosion Proof Valve

The X5 explosion-proof solenoid valve is announced by Skinner Electric Valve Div., Skinner Chuck Co., Norwalk, Conn. It is essentially the same general design as the company's V5 type, but with modifications to meet or exceed Underwriters Laboratories' requirements for Class I Group D explosion-proof construction.



New details include top nut which has increased thread engagement and is flanged to increase leakage path, cap which is machined from solid steel and is brazed to coil housing, and body which provides greater thread engagement with flange and is machined to effect a lap and rabbet joint coil housing. The coil housing is machined from heavy wall steel tubing and fits the body with a clearance of less than one thousandth of an inch.

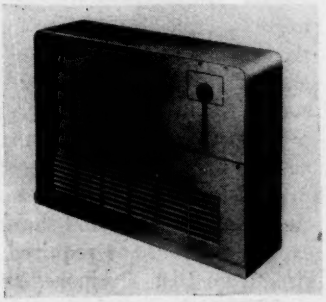
Small size and light weight are made possible by closely held fits which allow reduced joint lengths, steel construction which reduces required wall sections, and elimination of bulky bolted flange type of construction.

Low cost is achieved by simplicity of parts and elimination of castings which do not lend themselves to high production automatic machining and which cause rejects due to porosity, hard spots, and distortions caused by unsymetrical sections.

For more information, circle on Inquiry Card, **Item 1**

## Extra Quiet Unit Heater

A new model deluxe floor type unit heater, with front outlet for use in churches, offices, corridors, lobbies, stores and display rooms, is available for immediate delivery from Herman Nelson Div., American Air Filter Co., Inc., Moline, Ill. It is designed for applications where extremely quiet operation and attractive appearance are prime requisites.



The front outlet feature enables the unit to be recessed into walls. Outstanding feature of the new unit is its flexibility. It incorporates a universal coil for either steam or hot water application. In addition, the coil is positioned so that piping can be brought in from either side of the unit. The heater is also equipped with an adjustable pitch motor sheave for varying air volume requirements.

The unit is finished in satin-smooth tan, and is constructed of heavy furniture steel.

Other features are explained in Catalog 3495.

For more information, circle on Inquiry Card, **Item 2**

## Registers for Perimeter Heat

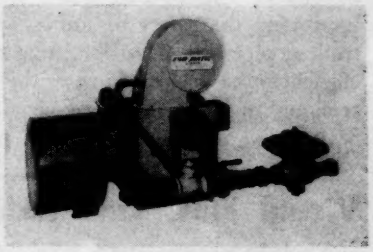
A line of new perimeter baseboard registers has been developed by Standard Stamping and Perforating Co., Chicago, Ill. Two models are available, one with vertical, the other with a sloping front as shown in the illustrations.

Each four-foot section has its own individually operated sliding damper control that can be adjusted easily for minimum, medium, or maximum control. The registers are fabricated of 20 gage steel, finished with prime coat only, and available in special finishes upon request.

For more information, circle on Inquiry Card, **Item 3**

## Burner for Both Gas and Oil

The Fyr-Matic gas-oil burner, designed for industrial and commercial use in applications where both oil and gas are available is announced by Eclipse Fuel Engineering Co., Rockford, Ill. Changeover from one fuel to the other is made instantly by the flick of a switch, making it possible to alternate the use of fuels back and forth according to availability, economy or suitability.



Among the features are dual atomization, making possible use of oil or gas with equal efficiency; rotary flame action with built-in tuyere; simplicity of installation with all internal wiring and piping supplied; compact design, including adjustable burner support, eliminating costly platform construction; and instantaneous, electronic flame failure control whether gas or oil is used. The burner is a self-contained package with no extras to buy.

Mixed, natural or L-P gas or number 1, 2, or 3 fuel oil may be used in the burner. Either gas or oil can be burned without induced secondary air as the burner is designed to furnish its own air for complete combustion.

For more information, circle on Inquiry Card, **Item 4**

## Pyrometer with 2-Scales

A hand pyrometer with two scale ranges for the rapid and convenient measurement of surface, liquid, gas and molten-metal temperatures is announced by General Electric Co., Meter and Instrument Department, Schenectady, N. Y.

Designated as the Type FH-1, the pyrometer is especially useful where a temperature detector does not need to be installed permanently. Its two scale ranges are 0-500 F and 0-1500 F, and the change from one scale to the other is accomplished by the flick of a switch.

Three interchangeable tips available for the new pyrometer include a surface tip, an immersion tip for liquids and molten metals, and a two-prong contact tip. These tips, together with flexible and rigid extension arms, can be easily changed.

For more information, circle on Inquiry Card, **Item 5**

## Indicates Oxygen Content

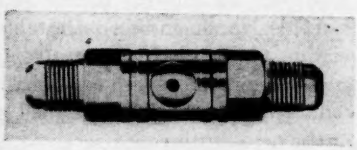
A new and improved version of the MSA oxygen indicator has been introduced by Mine Safety Appliances Co., Pittsburgh, Pa. Called the Type C-2 oxygen indicator, the new instrument is said to be more easily operated and maintained than the older Type C.

The indicator can be used for a variety of operations in industry. It measures the oxygen content of inert and combustible atmospheres in chemical, metallurgical, and petroleum industries. Through the measurement of the oxygen content of fuel gases, it provides a means for improving the safety of utility operations and for controlling pipe line corrosion. As a measure of combustion efficiency, the device can show the way to substantial fuel economy in many large industrial installations.

For more information, circle on Inquiry Card, **Item 6**

## Visual Flow Line Indicator

A simple, positive and inexpensive flow indicator which is incorporated into the pipe line and permits instant visual inspection without the necessity of reading pressure gages, is announced by Allin Mfg. Co., Chicago, Ill. Known as the Liquid Eye it consists of a brass housing in which is inserted a transparent high pressure Pyrex tube with a ceramic eye which visually magnifies when the liquid line is full. The straight-through design eliminates pressure drop.



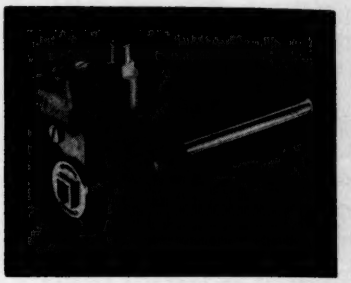
The device has been designed with the Pyrex glass tube spring mounted for shock resistance and the method of seating the gasket against the ends of the lapped glass prevents the glass from touching the housing. Assembly is completed with torque wrenches to secure absolute uniformity and the indicator is so light in weight that there is practically no fatigue factor in the liquid line. Three styles are available in copper tube sizes of ¼, ⅜, ½ and ⅝ inch with male flare ends (illustrated), female to male flare ends with copper flare insert in the female end, or with solder connections.

The indicators are practical in boiler feed water conditioner lines, oil pressure lines, Diesel fuel oil lines, refrigerant and other chemical lines.

For more information, circle on Inquiry Card, **Item 7**

## Gas Water Heater Control

The G4G all-in-one gas water heater control has been made available by General Controls Co., Grayson - Greenamyer Appliance Controls Div., Glendale, Calif. The control is a less expensive version of the deluxe G2G water heater control.



The new control is intended for use with city gases only. It is equipped with a thermomagnetic safety and operated by extremely few moving parts. It also features a unique reset operation. Designed specifically for use in less-expensive water heaters, the control is built compactly, occupies a minimum of space and further provides safe lighting, amplified snap action thermostat, and thermomagnetic safety.

For more information, circle on Inquiry Card, **Item 8**

## Duct Fan for Heavy Duty

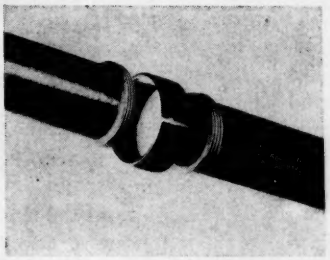
The Type PLDX duct booster fan has been introduced by Chelsea Fan & Blower Co., Inc., Plainfield, N. J. It consists of a heavy duty belt driven fan, with motor outside of airstream, for use in paint spray booths, large range hood exhausters, or in ventilating or heating systems. The fan is recommended for temperatures up to 350 degrees F. It is relatively quiet and will operate against moderate static pressure up to 2 inches. Equipped with non-overloading cast aluminum airfoil type propellers, these units include ball bearings and the motors are semi-enclosed or explosion proof, as required. The fans are available in sizes from 16 to 36 inches and air deliveries from 2,700 to 23,000 cfm.

Catalog 400 and Bulletin 405-A are available.

For more information, circle on Inquiry Card, **Item 9**

## Joint for Ceramic Pipe

A new joint and ceramic pipe for industrial use in conveying liquids and gases, is introduced by The Robinson Clay Product Co., Akron, Ohio. Known as Screw-Seal the new joint development combines plastic with vitrified clay to form a leak-proof, infiltration-proof joint. The clay pipe, with extra-heavy wall thickness, is manufactured with a threaded joint made of Plastisol, a vinyl resin dispersed in a fluid material, which becomes a rubber-like plastic upon heating. It is resistant to 54 corrosive acids and to most noxious gases.



The new pipe and joint is available in 4, 6 and 8-inch internal diameters, with standard fittings.

The joint employs the matching thread principle. Each clay pipe end is made dimensionally accurate in the application of plastic, which is cast directly on the pipe with the outer surface molded to tapered thread. This provides two male-threaded ends on the clay pipe, which thus becomes an integral part for all practical purposes. Pipe lengths are joined together by a threaded pressure molded plastic collar with matching female threads.

To assemble the joint, the pressure molded plastic collar is threaded over the stationary clay pipe end, and the pipe to be added to the line is turned into the collar by hand. This operation is accomplished in a minute or so through three complete revolutions of the pipe by hand and a fourth and final turn with a strap wrench.

In hard-to-get-at places, use is made of a pressure molded type union in the form of a split flange bolted together at the sides.

For more information, circle on Inquiry Card, **Item 10**

## Remote Type Conditioner

A remote type room air conditioner for multiple installation to provide both summer cooling and winter heating has been placed on the market by American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Called the Remotaire, it is designed for installations in office buildings, apartment houses, hotels, motels, hospitals and residences. Connected to centrally located water heating and cooling plants, the unit offers individual control of temperature in every room without affecting adjoining spaces.

The units are made in two sizes. In the large model, twin centrifugal fans deliver 400 cfm of conditioned air while a single fan delivers half that volume in the smaller unit.

Chilled or heated water, depending upon the season, is pumped from a centrally located water chiller and heating plant through a simple piping system to finned tubes in the unit. Circulating air passes around these tubes, is heated or cooled, then forced into the room.

Room temperature is controlled by three factors. One, the temperature of the water passing through the coils. Second, the amount of outside air entering the unit and, third, by the speed with which the fan blows the ventilating air over the coils into the room. Any of four standard control packages can be selected.

For more information, circle on Inquiry Card, **Item 11**

## Oil Heat Exchanger Control

The Paraprobe fuel oil heater control is being marketed by Davis Engineering Corp., Elizabeth, N. J. This is an electrical device designed continuously to monitor the condition of conductive liquids so as to detect undesirable contaminations, and to give adequate warnings of such contaminations to the operating personnel.

An exploratory electrode or probe is used to impose a fixed low voltage on the liquid stream under scrutiny. In the event of contamination, the change in electrical conductivity of the contaminated liquid will in a very few moments cause the control relay to close the alarm circuit.

When used in conjunction with oil preheaters, a second set of contacts in the snap-action switch controls the operation of the oil burner and oil pump.

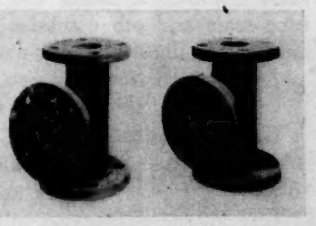
The control can be used in either below-the-water-line oil heaters or with steam heaters.

By its quick reaction to the presence of oil in either the boiler water or steam condensate, the control prevents the spread of the oil contaminated boiler circulation water or steam condensate to the boiler itself.

For more information, circle on Inquiry Card, **Item 12**

## Treatment Destroys Rust

A chemical treatment that removes rust, tarnish and light oil, chemically prepares metals for paint, and retards corrosion, is announced by Octagon Process Inc., Staten Island, N. Y. Known as Rustclean, the compound destroys rust and rust-promoting surface contaminants, thereby retarding corrosion. It not only chemically cleans the surface of steel, iron, aluminum, zinc and cadmium, but also forms a phosphate coating which acts as a base for organic finishes. It is also an effective tarnish remover for copper and its alloys.

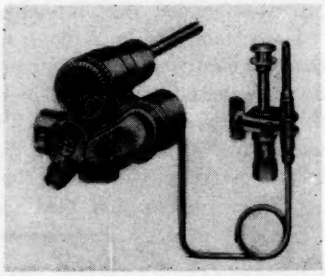


Corrosion is not limited to metal processing plants. Some applications not in the metal fabricating field include maintenance of storage tanks, machinery, steel partitions and stairwells, large architectural pieces, petroleum equipment and pipelines. Illustration shows pipe tee before and after treatment.

For more information, circle on Inquiry Card, **Item 13**

## Gas Water Heater Control

A complete line of automatic controls for all types of gas water heaters has been announced by the appliance controls division of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. They can be used with natural, manufactured or LP gas.



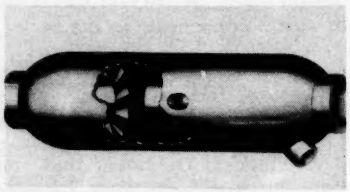
Featured in the new line is a compactly designed, easily serviced gas water heater control (V-5105) that has AGA approval for use in installations where safe lighting is mandatory. Component parts of this control are a main gas cock with pilot position valve, a pilot adjustment screw, a flow regulating valve, a thermostat and a thermomagnetic pilot that can be completely shut off in all positions.

Another of the valves introduced (V-5115) functions similarily but is specifically designed for use as a concealed water heater control. It can be installed flush on the outer jacket on heaters having 1⅝ inch insulation.

For more information, circle on Inquiry Card, **Item 14**

## Low Cost Line Type Purifier

A new low-cost line type purifier, Type LC Hi-eF, is announced by the V. D. Anderson Company for smaller pipelines from ½ to 2 inches. The low price of these units, according to the manufacturer, permits purifiers to be used for the first time for many installations formerly considered uneconomical.



A few of these applications are (1) to clean up steam processing lines to get better production out of kettles, sterilizers, laundry equipment, vulcanizing machines, etc. (2) to protect small engines, turbines, and regulating equipment from pipe scale and other solids (3) to remove entrainment from vapor lines following evaporation or distillation (4) to purify steam for food processing lines and (5) other steam and air applications, such as protecting rotating steam drums, steam ejectors, steam jacketed kettles, air tools, spray painting, and inter-coolers for gas compressors.

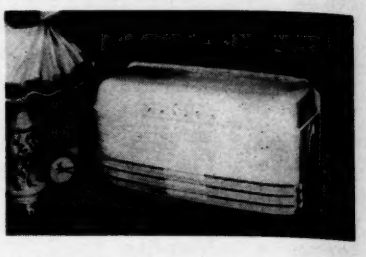
The purifier removes entrainment by an improved centrifugal element within the unit which engages and imparts a rapid rotational motion to entrainment laden vapor, throwing the solids and water outward to the walls of the purifier. Each unit is warranted to remove more than 99% of the entrainment. The purifier is installed like a valve or steam trap and is very compact. The 2 inch size is 5 inches in diameter and 17 inches long.

Bulletin 500 is available.

For more information, circle on Inquiry Card, **Item 15**

## Low Priced Room Coolers

The 1952 line of room air conditioning units recently announced by Philco Corp., Philadelphia, Pa., features a 1/3 hp unit retailing at $229.95. This low priced unit is said to fill the growing need for cooling smaller size bedrooms, dens and offices. A feature is the automatic temperature control which minimizes the possibility of the temperature dropping too low in the room if there is excessive change in the weather.



A number of designs are available, illustration showing Model 33-HL designed especially for bedrooms.

For more information, circle on Inquiry Card, **Item 16**

## Industrial Chilling Machine

A new model industrial chilling machine to meet the needs of smaller capacity users, and selling for under $3000, is announced by Sub-Zero Products Mfg. Div., Deepfreeze Distributing Corp., Cincinnati, Ohio.

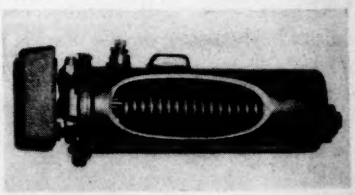
The new model, Sub-Zero W-120, has a capacity of 5 cu. ft., and will maintain temperatures as low as —120F. At this temperature it will remove 500 Btu per hour.

The W-120 is expected to be of special interest to operators of smaller heat treating departments. The increased use of chilling steel for quick and total stabilization has developed a need for the cooling units in heat treating plants and departments whose size did not necessitate the larger capacity models.

For more information, circle on Inquiry Card, **Item 17**

## Controls Viscosity of Heavy Oil

The Viscos-O-Trol, a device which heats heavy fuel oil on its way to the burner so that the burner is operating with oil at the right viscosity, is available from Superior Engineering Co., Seattle, Wash.



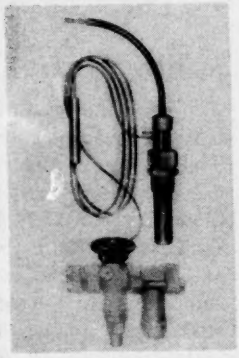
The oil flows through the copper coils shown in the accompanying cutaway view, which are surrounded by a water filled chamber. The heater element is immersed in water instead of coming in direct contact with the oil, thus preventing carbonizing of the oil on the heater element. The unit controls the temperature of the oil to within 2 degrees F and cannot accumulate sludge as there is no settling chamber. Oil cannot be cracked, separated and gasified as may occur when oil comes in direct contact with the heater.

The device can be installed on any rotary or mechanical atomizing oil burner unit using heavy oil.

For more information, circle on Inquiry Card, **Item 18**

## Liquid Level Control

The Level-Master control for flooded refrigerant systems is announced by Sporlan Valve Co., St. Louis, Mo. It is a positive liquid level control device for ammonia, Freon-12 and Freon-22 applications, and combines a liquid level control and refrigerant expansion device into one unit.



The control comprises a standard thermostatic expansion valve equipped with a conventional thermostatic element and a low wattage heater. The heater provides an artificial superheat to the thermostatic charge. As the liquid level drops, the heater temperature increases, the pressure in the thermostatic element thereby opening the expansion valve which feeds refrigerant into the low side. When the liquid level rises and makes contact with the bulb, the refrigerating effect overcomes the heater and the valve throttles. Tight closing is assured during the off cycle, when the heater is off and liquid is in contact with the insert bulb. The control provides a modulated flow and maintains practically a static liquid level in the low side.

Installation is simple and economical in either new installations or conversion jobs. The insert bulb is placed directly in the shell, accumulator or liquid leg for direct contact with the refrigerant. Existing hand and float control systems can be easily and economically modernized and made automatic with the control.

For more information, circle on Inquiry Card, **Item 19**

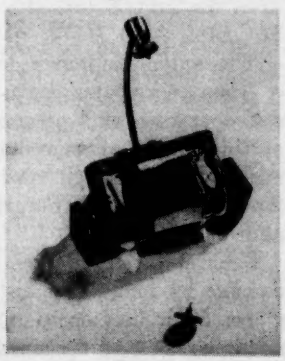
## Cooling Unit for Air System

Limited production in 1952 of a new summer cooling unit, for use with its Blend-Air heating and ventilating system, is announced by The Coleman Co., Inc., Wichita, Kan. The new unit will be in two and three-ton sizes.

For more information, circle on Inquiry Card, **Item 20**

## Improved Recorder Pens

New industrial instrument pens that eliminate flooding and reduce paper plugging and choking have been designed by Minneapolis-Honeywell Regulator Co., Brown Instrument Div., Philadelphia, Pa., for its strip chart electronic instruments. The new pens have removable tips and a new reservoir construction which eliminates flooding because the effective ink level is always below the writing tip.



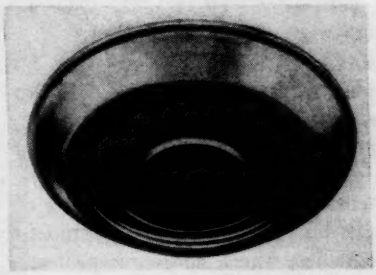
Among other advantages are: The pen operates with decreased pressure on the instrument chart, tending to reduce paper fiber choking; thorough cleaning is made easy by a simple disassembly, and the new design fits on standard pen carriages, permitting improved performance for already installed instruments.

The writing tip is made of platinum alloy. It will wear even better than former models because the pen pressure has been decreased to about one third through the use of the counterweights.

For more information, circle on Inquiry Card, **Item 21**

## Residential Air Diffuser

A simple, low cost ceiling air diffuser for forced warm air systems in houses has been developed by W. B. Connor Engineering Corp., Danbury, Conn. Stripped of non-essential controls, the unit is designed and styled for residences, although retaining the performance characteristics of the company's standard industrial models.



A small, dome-shaped outlet, its lines and silhouette make it hardly more conspicuous than a light fixture. It consists mainly of a collar or neck and an inner and outer deflector. The inner deflector is positioned so that the air is discharged in an outward and downward direction. The outer deflector is essentially a rounded shoulder further to divert the air from the adjacent ceiling area. Rapid, draftless and thorough heat distribution, with room temperature variations of no more than 1-1/2 deg. are among the advantages claimed.

Introduction of warm air from the ceiling in an umbrella pattern and the pull out of the cooler air by the baseboard grilles counteracts the tendency of warm air to rise. Entrainment or mixing of room air with the supply air is at the ratio of 4.5 parts of the former to 1 part of the latter, the process taking place within a few inches of the diffuser and well above the heads of occupants.

For more information, circle on Inquiry Card, **Item 22**

## Heavy Duty Furnace Cleaner

A heavy duty furnace and boiler vacuum cleaner is being manufactured by Pullman Sales Corp., Boston, Mass. at a list price of $111.65.

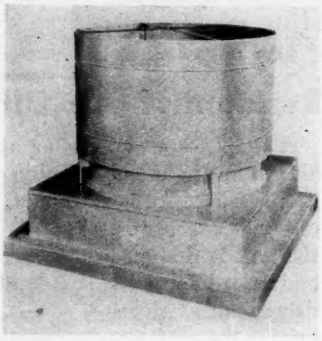
The complete unit with attachments weighs 30 lb and can be carried into the basement with one hand. Designed primarily for homes and small commercial installations it has a capacity of 1½ bushels.

An internal filter is used so that there is no outside bag to snag or tear. The device can be quickly converted to a blower for soot in tubes.

For more information, circle on Inquiry Card, **Item 23**

## Low Height Power Exhauster

An upblast power exhauster with low silhouette has been announced by The Gallaher Co., Omaha, Neb. The largest model, with a certified rating of 22,000 cfm, stands only 54 inches high. Smaller models range down to a 42-inch height with a 10,250 cfm rating.



The low silhouette was developed to cut down on overturning effect. The company claims that large numbers of the new upblast units may be installed on present roof structures without excessive danger from overturning.

The fan blades (four or six), machined from high-tensile, cast aluminum alloy, are of air foil design. Blades are designed for field replacement without purchase of the complete wheel, and come protected by a vinylite coating which is resistant to acid and alkali fumes.

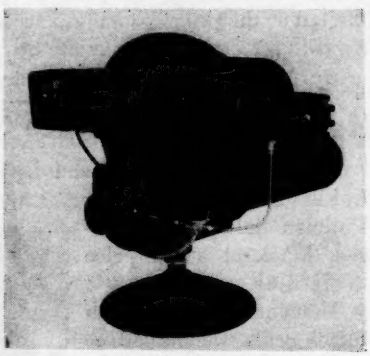
Motors are totally enclosed, standard types, although D.C. and special voltage models can be made to order.

The unit is shipped as a complete package, ready for field installation, and can be ordered either with or without base.

For more information, circle on Inquiry Card, **Item 24**

## Commercial Fuel Oil Burner

An oil burner specifically designed for large commercial and small industrial automatic heating installations is introduced by Anchor Div., Stratton & Terstegge Co., Inc., New Albany, Ind. Designated as Model SA5, the burner features an adaptation of the Shell combustion head, which makes possible important fuel oil savings. Complete mixing of oil and air in the combustion chamber achieves maximum thermal efficiency to produce hotter, more uniform, soot-free heat.



Capacity of the burner ranges from 5 to 10 gallons of No. 2 or lighter fuel oil per hour. It is compact, measuring 28¼ inches wide and 35½ inches deep. Height is adjustable from a minimum of 24 to standard 26¼ inches; shipping weight is 165 lb. A heavy cast frame construction minimizes vibration, safeguards working parts, and preserves their alignment.

The unit is equipped with a two-stage Sundstrand fuel unit. Pumping components function with a rolling action that minimizes wear and results in quiet performance. Quick, positive cutoff is provided by a delayed-action magnetic solenoid valve. Controls are mounted on the burner and respond instantly to flame failure since the flame is a connecting link in the control system. Thus, the risk of a remote stack switch is eliminated and safety is assured on a split-second basis.

For more information, circle on Inquiry Card, **Item 25**

## 3 Hp. Crane Cab Cooler

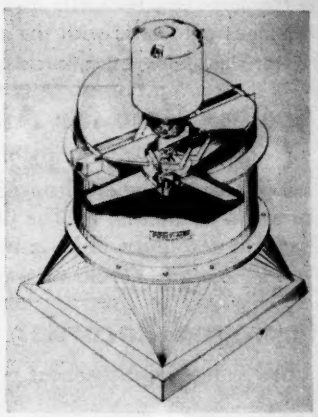
To complete its line of crane cab air conditioning and ventilating equipment, Dravo Corp., Pittsburgh, Pa., has developed a new split-type crane cab cooler of the 3 hp. size. This model, the C-3SP, is designed to maintain a temperature of 80 to 85F within a crane cab when the ambient temperatures reach 130F. The unit which supplies continuous ventilation, is equipped with electric strip heaters for winter heating, dust and dirt filters and activated carbon canisters for fume and odor removal.

Operation and control for summer and winter temperatures is fully automatic. The small, compact evaporator section can be installed within the cab, while the condenser section may be located in any convenient place on the crane. The two sections are connected by refrigerant piping.

For more information, circle on Inquiry Card, **Item 26**

## Power Driven Roof Ventilator

The Posit-Aire roof type ventilator which moves maximum volume of air ranging from 5,000 to 45,000 cfm, depending upon size, is available from Tripar Products, Inc., Royal Oak, Mich. When the fan is started, mechanically actuated louvers open fully and automatically. Power to open louvers is provided by the fan drive motor through a simple lever-clutch mechanism. When fan is stopped, the louvers close positively and lock in closed position until the unit is turned on again.

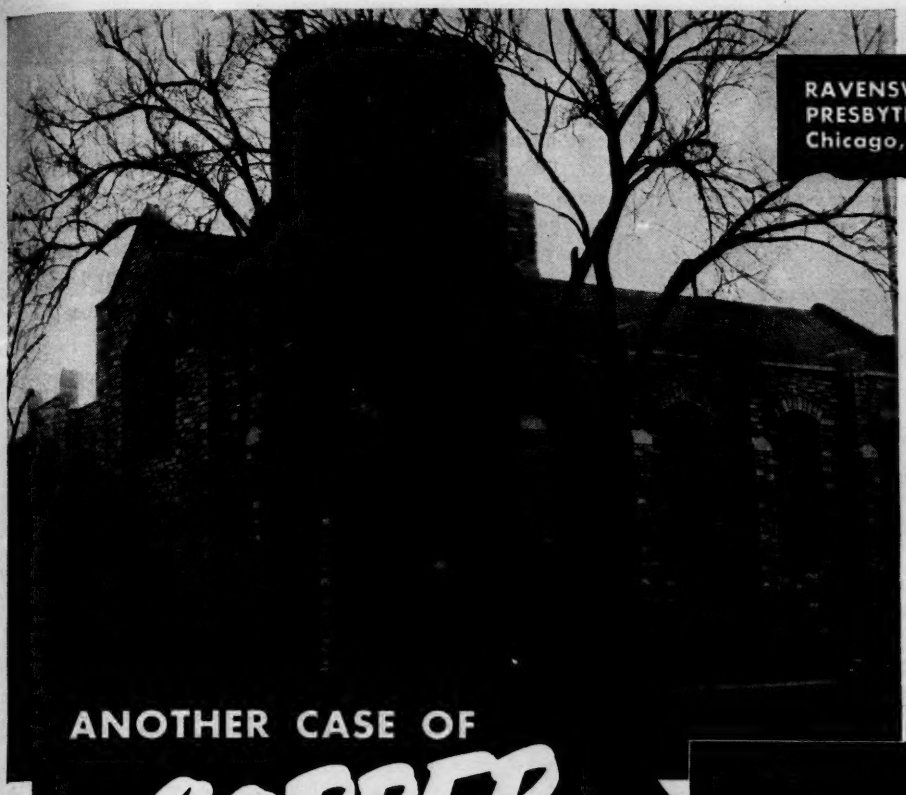


This automatic louver design prevents entrance of rain or snow, eliminates drafts or stack effect when unit is not operating and prevents back-draft or entrance of outside air. It offers reduction in fire hazard by eliminating draft through roof in event of a fire. Because louvers lock closed, burglar and sabotage protection is afforded.

Exhaust air discharges upward to protect roof from damage by fumes or moisture removed from plant. Engineered for field erection, unit can be supplied without motor or base for economy in shipping, storage and handling. Standard sizes range from 24 to 48 inches.

For more information, circle on Inquiry Card, **Item 27**

(*Continued on page* 124)



RAVENSWOOD
PRESBYTERIAN CHURCH
Chicago, Ill.

(Below-Top) Section of radiant panel heating system before concrete was poured. 16,500 ft. of ¾"; 2,000 ft. of 1¼" and 1,500 ft. of 1½" Revere Copper Water Tube were used. Architect and Engineer, Benj. Franklin Olson; General Contractor, Harry C. Bjorklund & Son; Revere Distributor, The Davies Supply Co., all of Chicago. Harden Heating & Air Conditioning Co., of Elmwood Park, Ill., was Heating Contractor.

(Below-Bottom) Shows arrangement of balancing cocks on a return header. System was designed for zone control, a most important requirement for efficient operation in this type of edifice.

# ANOTHER CASE OF COPPER where it counts!

CHURCHES, schools, colleges, municipal, office and similar buildings must be built to last. It's the only way to make them pay. That's why you'll find enduring materials like copper, brass and bronze used in so many places in so many of them.

The lasting quality of Revere Copper Water Tube was one of the reasons for its being used for the radiant panel heating system in the Ravenswood Church. Revere Copper Water Tube is non-rusting. It costs no more for workmen to install because its 60′ lengths are easy to bend and handle . . . it requires fewer fittings than rustable, short-lived materials. What joints are necessary are permanently soldered in a jiffy. That's why more and more architects, engineers, builders and contractors have been using it where it counts.

Although copper tube cannot now be used in civilian installations of radiant panel heating, we cite the Ravenswood Presbyterian Church to remind you of the merits of Revere Copper Water Tube over other materials so that when copper is once more permitted you will again use it. Meantime remember, you can still use Revere Copper Tube in underground service lines, domestic hot and cold water supply lines, industrial processing and for gas equipment.

Revere Copper Water Tube is available in hard and soft tempers in straight lengths; also in 60′ coils in soft temper. Each length is marked with the Revere name. Look for this mark. It assures you of uniform quality. These materials are available through your Revere Distributor, who will also put you in touch with Revere's Technical Advisory Service in the event you wish to discuss your technical problems.

**REVERE**

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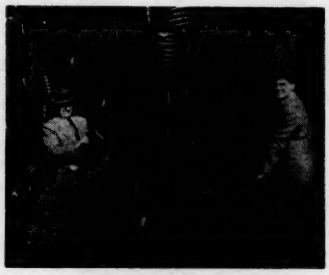
**SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY**

(*Continued from page* 122)

## Corrosion Proof Pipe 1/2 to 6 In.

A complete range of flexible and rigid plastic pipe for every piping need is being manufactured by The Plastex Pipe and Extrusion Co., Columbus, Ohio. This corrosion proof pipe has many applications in water wells, chemical processing, drainage and irrigation lines and general piping of pure or corrosive liquids and gases. It has positive resistance against rust, rot and electrolytic corrosion and the smooth interior surface provides maximum transmission with very low friction losses. It is light weight, weighing about one-tenth that of equivalent metal pipe, reducing freight, handling and installation costs. Installations above or below ground are accomplished without special tools and connections are easily made with cemented plastic fittings. The pipe comes in a complete range of standard pipe sizes from ½ up to 6 inches. Coils are made up to 400 ft long and straight lengths 25 ft long. Illustration shows a 200 foot coil of 2 inch pipe weighing 80 lb.

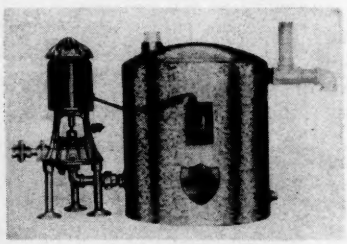


For more information, circle on Inquiry Card, **Item 28**

## Condensation Return Unit

A new type of condensation return unit, said to have a wide variety of applications in industrial plants requiring circulating hot water, air conditioning service, or boiler feed is being manufactured by Advance Pump Co., Berkeley, Calif., and Hamilton, Ohio.

Called the Heatsaver, it consists of a vertical high-pressure type centrifugal pump with 1/4 hp. single phase motor and a 20-gallon galvanized tank with float switch.



Its ease of installation, compact size and quiet operation are among the advantages of the new unit cited by the manufacturer for service in lumber mills, cleaning and dyeing plants, dairies, nurseries and other smaller plants requiring efficient, low cost utilization of hot water or steam.

Pumping capacity is from 2 to 33 gpm, at discharge pressures ranging from 4 to 60 lb, depending upon the type of installation required.

For more information, circle on Inquiry Card, **Item 29**

## Acid Proof Exhaust Systems

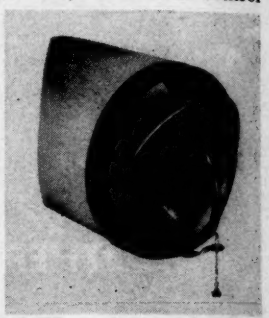
Exhaust systems for corrosive vapors and fumes, fabricated throughout from Polyethylene, are offered by American Agile Corp., Bedford, Ohio. These installations, including tanks or tank liners, exhaust hoods, fume ducts and fume stacks, or parts of such systems, are built to customer's specification.

Polyethylene exhaust and duct systems offer corrosion resistance against most acid fumes, including hydrochloric, hydrofluoric, sulfuric, and nitric acids. They are easy to clean and will outlive most other construction materials when used between—20 F and 170 F.

For more information, circle on Inquiry Card, **Item 30**

## Gas Installation Draft Control

A draft control for gas-fired jobs is announced by Cole-Sewell Engineering Co., St. Paul, Minn. This control is of the barometric type and is precisely balanced to hold an accurate draft.



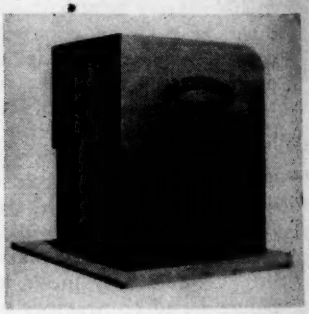
Elimination of all back pressure or downdraft from entering the boiler or furnace through the smoke vent is claimed. The control blade swings inward under draft condition and swings out on pressure or downdraft.

Full range of sizes is available. The 7 through 12 inch models are furnished with knife-edge non-clogging bearings and the larger sizes to 48 inches are equipped with oilless ball-bearing picots. The simplicity of design of all working parts is said to be such that trouble-free operation at all times can be expected.

For more information, circle on Inquiry Card, **Item 31**

## Compressed Air Dehumidifier

A dehumidifier for compressed air is announced by Glenwood-Inglewood Co., Minneapolis, Minn. It is said to be the first, fully automatic mechanical dryer for compressed air.



The unit has a Tecumseh hermetically sealed, 1/6 hp Freon-12 condensing unit in a circuit with a sealed time-delay relay and Spencer disc thermal overload protection.

Dual heat exchangers are arranged in a system with means for reheating the dry leaving air, resulting in high overall efficiency. The unit measures 12 x 17 x 20 inches and weighs 85 pounds.

Applications include pneumatic control systems which can be supplied with dry air, and packaging machines which have fewer hours of down-time when dry air is employed. Many industrial applications ranging from chemical laboratory use to printing machinery will become more productive when dry air becomes more widely used.

For more information, circle on Inquiry Card, **Item 32**

(*Concluded on page* 126)

# THRUSH *Heating Manual*

FORTY FACT FILLED PAGES

## *Radiant Heat* WITH FORCED CIRCULATING HOT WATER

**HERE'S valuable help for you! Designing and installing forced circulating Thrush Flow Control Hot Water Heat is greatly simplified by the many diagrams and tables contained in this book. It has been improved and expanded to nearly double its previous size with a large section on radiant heating engineering. Various zoning methods are fully described. One-pipe and two-pipe flow control systems are illustrated and designed step by step for further simplification. The book is in four parts. Boiler details are featured with appropriate wiring diagram shown for each installation. Capacity tables are presented in new form for sizing of mains, branches and selection of Thrush Equipment. Domestic water installations, unit heater hook-ups and even snow melting applications are covered. Installation of the complete Thrush Flow Control System has always been simple and easy, but now you will find it easier than ever. The forty fact-filled pages of this new Thrush Manual will be invaluable to you on every hot water job you install.**

If you are not now installing Thrush Equipment, it is time to get acquainted. See your wholesaler or ask for more information on the coupon.

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**H. A. THRUSH AND COMPANY**

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- ☐ We are using Thrush Equipment. Please send us your new, simplified Engineering and Installation Manual.
- ☐ We have not been users of Thrush Equipment but would like to have your literature.

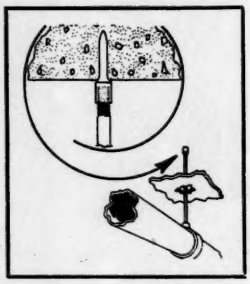
NAME _____

ADDRESS _____

(*Concluded from page* 124)

## Improvements in Powder Tool

Tru-Set fasteners for greater consistency in anchoring in steel and concrete are announced by Ramset Fasteners, Inc., Cleveland, Ohio. The fasteners are held straight in the barrels of Ramset and other powder actuated tools by an elasticized red tip. The tip pilots the fasteners into the work, virtually eliminating the need for manual straightening of fasteners.



Other advantages include that the new fasteners provide for greater penetration from the same amount of power, automatic cleaning of tool barrels, higher quality and more effective fastenings, and greater power control, more jobs and tougher ones done with powder tools than before.

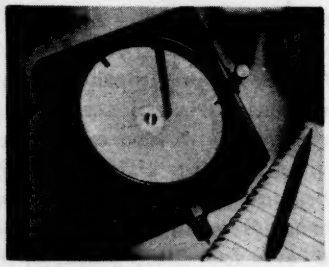
The new models also eliminate one step in the operating cycle which establishes a practical standard of approximately 20 seconds for the complete operating cycle.

Previous to the development of these fasteners, the drive pin and threaded stud type fasteners, were held in the breech of the tools by a thin flange, which was sheared off when gas pressure developed to a maximum. Now the fasteners with no flange at all are actually inserted in the breech plug right under the powder load. The elasticized tip at the point end of the fastener completes the seal and prevents the fastener from being tilted while in the barrel of the tool.

For more information, circle on Inquiry Card, **Item 33**

## Very Low Temperature Recorder

Development of an exceptionally compact instrument for measuring and recording very low pressures is announced by The Dickson Co., Chicago, Ill. Known as the Type 3-B Minicorder, this instrument is designed for chart records as low as 0 to 10 inches head of water pressure, with other chart ranges available to as high as 0 to 60 lb per sq in. Over all dimensions are 5¼ by 5¼ by 2¼ inches deep. It weighs 2 pounds.



The instrument has a calibration adjustment, a simple device that permits range adjustment at any point on the chart, for exact setting. The measuring elements are enclosed in a sturdy all metal case, completely rubber gasketed for protection from dust, moisture and weather.

The entire operating unit is assembled to a heavy lacquered dial, with all parts quickly interchangeable. Pen arm tension and hub caps have been eliminated, for greater ease of operation and maintenance.

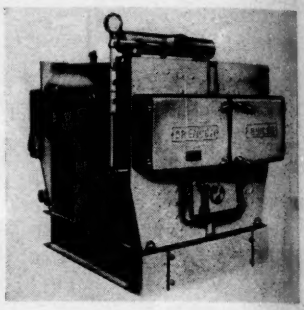
The device has a wide variety of applications, including measuring and recording pressures or vacuums in fan ventilating systems, air conditioning, gas distributing systems, combustion systems, partial and complete vacuum systems, to record liquid levels of all kinds, in tanks, reservoirs, rivers, lakes, and as high pressure draft gages.

The instrument can be calibrated in many different units and combinations, such as: inches of water, ounces per square inch, inches of mercury, pounds per square inch, and so on.

For more information, circle on Inquiry Card, **Item 34**

## Steel Boiler Split in Two

A steel heating boiler divided longitudinally and with a low water line is announced by Lycoming-Spencer Div., Avco Mfg. Corp., Williamsport, Pa. The purpose of the boiler is to overcome the problems encountered with conventional steel boilers in regard to limited head room, restricted entry facilities, excavation problems and need for low water lines. Maker claims that the new boiler is not only a solution to these problems but at the same time retain the advantages usually found in conventional firebox type boilers.



Designated as the LW Series, the overall height of the boiler and waterline are said to be approximately 25% lower than in conventional boilers. Although slightly wider, it is shorter and more compact. The divided design affords entry through narrower openings and requires no welding on the job. The outlet header is adaptable to either front or rear takeoff. It is also available with top or end connections or as a blank header for direct welding hook-up.

The boiler has a high firebox and combustion chamber of ample size above the water leg. It is adaptable to either front, rear or side installation of mechanically fired equipment or can be handfired with bituminous or anthracite coal.

The boiler rests entirely on four heavy corner posts and allows removal of front, rear and side base plates without disturbing boiler. Front corner posts of mechanically fired bases are prepared for installation of grate shaking equipment, thus eliminating need of replacement should owner desire to change method of firing.

Standard working pressures are 15 lb steam and 30 lb water, but the boiler is available for water working pressures up to 100 lb. All models are rated in accordance with the Steel Boiler Institute Code, and built in accordance with the A.S.M.E. Boiler Construction Code.

The boiler is available in 15 sizes with capacities ranging from 4,250 to 42,500 square feet of steam radiation or 6,800 to 68,000 square feet of hot water radiation.

For more information, circle on Inquiry Card, **Item 35**

# PRODUCT INFORMATION SERVICE

**Use the postage-free postcards below for further information on:**

- **News of Equipment and Materials**
- **New Catalogs**

**Circle the Item Numbers in which you are interested and print clearly your name and address with title.**

## NEW CATALOGS

**DRAWINGS FOR COPPER WORK**

A portfolio of 15 drawings which show suggested details of new or improved methods of sheet metal work frequently performed in residential and commercial construction is offered by The American Brass Co., Waterbury, Conn. The drawings, by the company's building experts, suggest designs which require a minimum use of sheet copper for maximum protection against weather, especially for chimney and wall flashings.....**Item 36**

**LINE OF AIR HANDLING EQUIPMENT**

A catalog of its range of ventilating fans, air circulators, belt-driven exhaust fans, and floor and window fans, has been brought out by Standard Electric Mfg. Co., West Berlin, N. J. Illustrated, 24 pages, with specifications.....**Item 37**

**SMALL PURIFIERS**

A 6-page bulletin No. 500 has been published describing the small line type Hi-eF purifiers developed by V. D. Anderson Co., Cleveland, Ohio. In this folder are listed many functions of this new unit which is used to clean up small pipelines carrying live or exhaust steam, vapors and air. These include applications on steam drums, ejectors, steam jacketed kettles, heat exchangers, vacuum canning equipment, laundry and dry cleaning equipment, intercoolers for gas compressors, air tools, spray painting, etc. In addition the bulletin describes the advantages which result in the use of these on such applications...**Item 38**

**WATER AND STEAM VALVES**

A new 8-page bulletin, G-3, describing features of its cushioned automatic water and steam valves is available from Golden Anderson Valve Specialty Co., Pittsburgh, Pa. Included are float valves, altitude valves, check valves, solenoid-operated valves, reducing valves, relief valves and non-return valves, valves used by municipalities and industries everwhere. .....**Item 39**

**FUEL SAVING IN PUBLIC HOUSING**

Nine ways to reduce heat waste and achieve important savings in fuel costs in public housing projects are described in a booklet published by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. The fuel conservation tips cover a variety of methods, ranging from proper combustion to zoning for wind and sun and thermostatic control in each apartment. The illustrated booklet, Save Fuel, Save Dollars, summarizes a presentation the company made before the Technical and Maintenance Section of the National Association of Housing Officials at a recent exposition. The information covers building design, construction and operation. .....**Item 40**

**PIPING DESIGN**

How to Use Schedule Numbers in Power Piping Design, Bulletin 515A, by Sabin Crocker, a reprint of an article, has been issued by Taylor Forge & Pipe Works, Chicago, Ill.....**Item 41**

**COOLING TOWER LUMBER**

Bulletin TSC-301 entitled Memorandum on the Maintenance of Cooling Tower Lumber, a progress report of Technical Subcommittee No. 3, 4 pages, has been issued by Cooling Tower Institute, Basking Ridge, N. J.....**Item 42**

**PAINT SPRAY ARRESTORS**

Form 1217, standard size, 12 pages, entitled Spray Paint Overspray, has been issued by Research Products Corp., Madison, Wis. It is a complete discussion of the company's paint arrestors and how they are used in various types of paint spray booths. .....**Item 43**

**CEILING FOR RADIANT HEATING**

Bulletin A-102, 8 pages, has been issued by Burgess-Manning Co., Architectural Products Div., Chicago, Ill., and devoted to its ceiling for radiant heating, radiant cooling and acoustical control. Profusely illustrated the bulletin shows function, operation and installation, including typical applications....**Item 44**

**SMALL TONNAGE CONDENSERS**

A four-page, two-color catalog No. 235 an Small Tonnage Condensers is available from Acme Industries, Inc., Jackson, Mich. Model J condensers are available in capacities from ½ to 25 tons. They are furnished with cast iron heads and through-bolted to the tube sheet and water gasket. The integral fin copper tubes are silver soldered permanently into chemically treated steel tube sheets which are welded to the condenser shell. Models SC are compact and sturdily built condensers. The integral fin copper condenser coil is rigidly held in place by being attached to the steel pipe and water inlet and outlet connections. They also provide ample pump down capacity. Condensers up to 6 inches in diameter are A.S.M.E. approved. The catalog shows tables, dimensions and engineering information. .....**Item 45**

**CATALOGS ON SMALL TURBINES**

Six bulletins describing its line of high-efficiency impulse type steam, gas or air turbines for mechanical drive, which has recently been expanded for general industrial use, is announced by The Pyle-National Co., Chicago, Ill. One of the bulletins is devoted to each of the five types of turbines available, ranging from ¼ to 120 hp, giving performance charts, constructions details, dimensions and weights and selection data. The sixth bulletin provides general turbine information. .....**Item 46**

**COOLING TOWERS, CONDENSERS**

Its 1952 catalog is just off the press, according to Baltimore Aircoil Co., Baltimore, Md. It includes complete descriptions, dimensions and selection charts for the company's new and expanded line of evaporative condensers and cooling towers. .....**Item 47**

**HOMES WITH AIR CONDITIONING**

A new book How to Have a Carrier Weathermaker Home describing dramatic and economical new home layout ideas made possible by positive residential comfort control has just been issued by Carrier Corporation, Syracuse, N. Y. It outlines a new way of planning a home from the inside out, with complete freedom from many old technological restrictions. .....**Item 48**

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### ROOF COOLING NOZZLES

Bulletin 20A, 2 pages, has been published by Water Cooling Corporation, New York, N. Y., on its Streamjet nozzles for roof cooling systems. These nozzles are for use in areas where water is scarce and expensive. .....**Item 49**

### FAN CATALOG

A complete catalog, price sheet and engineering bulletin describing 30 of its fans in over 300 sizes has been issued by Chelsea Fan & Blower Co., Inc., Plainfield, N. J. Included are specifications, dimensions, installation diagrams, photographs and descriptions...**Item 50**

### EXHAUST FANS

Bulletin 3429, devoted to its line of fans and featuring its direct drive vertical pressure fan for exhaust use in kitchens, attics and laboratories is available from Herman Nelson Div., American Air Filter Co., Inc., Moline, Ill. **Item 51**

### COMBUSTION CONTROL

An 8-page case history Bulletin R-8, describing the operation of the largest independent producer of electric power for manufacturing in Connecticut, Scovill Mfg. Co., is available from The Hays Corp., Michigan City, Ind. The equipment and operating philosophy which enabled this plant to achieve an evaporation rate of 12.8 and a cost per thousand pounds of steam of $.706 is fully covered. Use of steam, fuel and ash handling, and plant steam demand are discussed and illustrated. A large schematic drawing reveals the operation of the combustion control system; in addition, a drawing of the instrument panel is tied into actual photographs of functions of particular controllers. ..**Item 52**

### DATA BOOK FOR ENGINEERS

A 330-page, revised edition of the engineers and architects electrical data book, B-2161-E, is available from Westinghouse Electric Corp., Pittsburgh, Pa. It includes information on new equipment and new methods of using this equipment as well as an entire new section on power distribution. Complete and comprehensive, the book is so designed that detailed information on almost any type of electrical equipment is readily accessible. It is divided into the three general equipment categories of power plant, electrical distribution, and utilization and accessory equipment with one section on engineering data....**Item 53**

### CLOTH-BAG DUST COLLECTOR

An 8-page, two-color bulletin No. 914 on its new cloth-bag dust collector for carbon black, cork, fine wood, graphite, pigments, lime, soap, metal oxides and similar dusts, is announced by Pangborn Corp., Hagerstown, Md. Illustrated by 12 photos, seven line drawings, and two elevation drawings, the bulletin tells how the cloth-bag collectors work, and how they are installed and maintained. It also gives specifications of standard collector sizes and dimensions.....**Item 54**

### FUEL OILS AND OIL ADDITIVES

Availability of a technical folder on the problems concerned with the burning of modern fuel oils and the application of additives, is announced by E. F. Drew & Co., Inc., New York, N. Y. This folder presents data and information based on research aimed at the elimination of sludge, soot and slag in the burning of industrial fuel oil.....**Item 55**

### MULTI-PUMP CONTROLS

Bulletin 1510 on its multi-pump control has been issued by Automatic Control Co., St. Paul, Minn. It explains how the company's Autocon Duotrols are used to control two or more pumps...**Item 56**

### RENEWABLE DISC VALVES

A 4-page circular describing its renewable composition disc bronze valves has been issued by The Fairbanks Co., New York, N. Y. The Figure U-01 globe valve features this group which is assembled from the basic valve body with a few additional parts. An important portion of the circular is a description of the discs that are available in these valves. .....**Item 57**

### HEAVY OIL BURNER CATALOG

An eight-page, two-color catalog, Form AD-102, describing its complete line of Hev-E-Oil burners has been published by Cleaver-Brooks Co., Milwaukee, Wis. The catalog contains illustrations of the various sizes and capacities of the burners, including burners with maximum capacities of five to 60 gallons per hour. .....**Item 58**

### CARBIDE MASONRY DRILLS

A 6-page folder entitled Masonry Drill Bits has been issued by New England Carbide Tool Co., Inc., Cambridge, Mass. It describes, illustrates and gives dimensional and price data on the company's complete line of carbide drills and shows which drill should be used for a given type of masonry. Included are the following: Cyclo-Core rotary bit for precision drilling in hard concrete; Cyclo twist rotary bit for drilling in soft and medium hard masonry materials; Thunderbolt hammer bit for drilling in very hard masonry materials. .....**Item 59**

### SCHOOL VENTILATION

A 24-page brochure devoted to the Herman Nelson Draft Stop system of schoolroom ventilation has been issued by Herman Nelson Division, American Air Filter Co., Moline, Ill. This catalog, in five colors, contains detailed information on the principle of the school ventilation system and also illustrates the company's line of general purpose unit ventilators. .....**Item 60**

### AIR DIFFUSER CATALOG

A Kno-Draft adjustable air diffuser catalog, Bulletin K-20-A, has been published by W. B. Connor Engrg. Corp., Danbury, Conn. Comprising 32 pages and printed in two colors, it contains numerous revisions and additions, including temperature differential and mounting height scales, throw formulas to determine terminal velocities other than standard, expanded selection curves, air entrainment ratios, static pressure and resistance charts and simplified balancing and testing data.....**Item 61**

### RELIEF VALVE COMPUTER

An easily operated slide chart which tells at a glance the proper selection of relief devices required in accordance with the ASA Code for Mechanical Refrigeration has been issued by Henry Valve Co., Melrose Park, Ill. One side of the computer determines the discharge capacity, in pounds of air per minute, and number of relief devices required for all types of refrigerants in vessels of various sizes. With discharge capacity of the vessel determined in pounds of air per minute, the other side of the computer automatically selects, in terms of code requirements, the correct size and type of the company's relief valve and shows the maximum length of discharge piping permitted on the installation. Also furnished is a pocket folder for the selection of relief devices for mechanical refrigeration systems in accordance with the Chicago Municipal Code. .....**Item 62**

### CONVECTOR CATALOG

Six types of convectors are described and illustrated in Catalog 594 distributed by The National Radiator Co., Johnstown, Pa. The 28-page booklet shows both frequent and infrequent piping connections, roughing-in dimensions, and convector ratings for either steam or hot water use. Various types of heavy gage steel enclosures are described and illustrated; their roughing-in dimensions are listed. It also includes data on water pressure drop through convectors; a heat emission rate chart, comments on venting, and illustrations of typical installations. .....**Item 63**

### REGISTERS AND GRILLES

A pocket catalog that shows its complete line of registers, grilles, and frames, together with all necessary technical information is available from Standard Stamping and Perforating Co., Chicago, Ill. The convenient size, and clear, concise method of presenting the information, enables the men in the field to have with them at all times a representative line and specifications to meet on the job information requirements...**Item 64**

**PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.**

| | | | | | | | | | |
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| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | | | | | | |

**PLEASE PRINT** Apr. H/52

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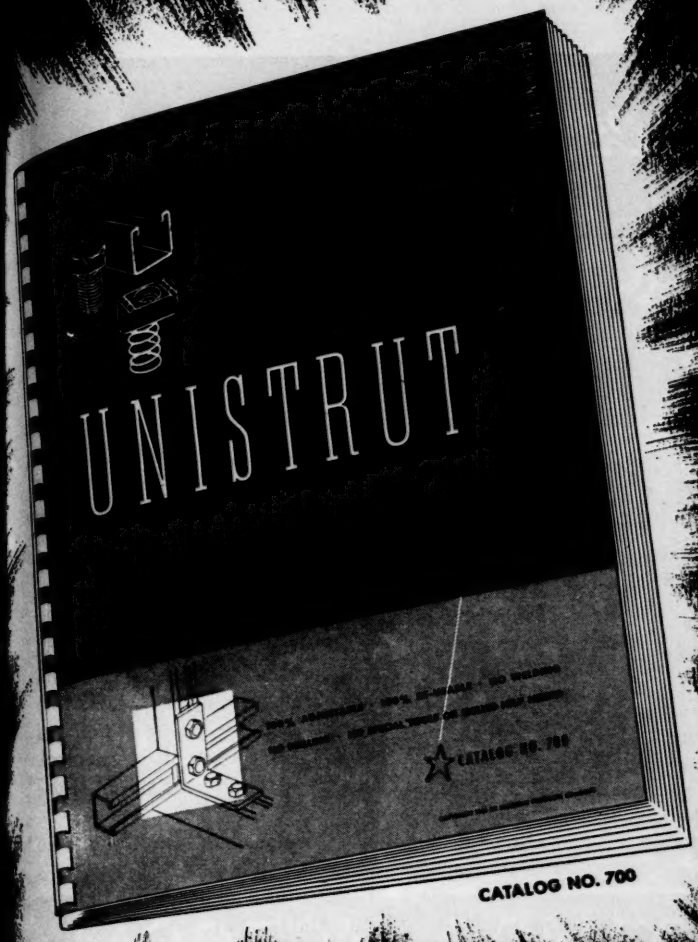
This card is void after July 1, 1952

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UNISTRUT includes concrete inserts, roller pipe supports, brackets, clamps and many other standard parts which in combination provide the world's most flexible system of support or suspension. UNISTRUT does the complete job—you need no other parts or materials.

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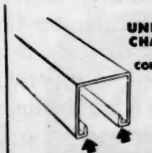
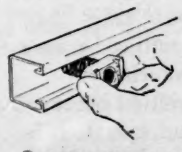


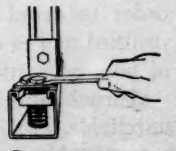

1 WEDGE SHAPED INTURNED EDGES TO TAKE SERRATED GROOVES OF UNISTRUT NUT.

2 SERRATED GROOVES "BITE INTO" INTURNED EDGES OF CHANNEL FOR POSITIVE CLAMPING ACTION.



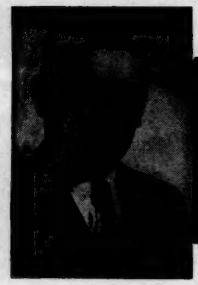
3 INSERT SPRING NUT ANYWHERE ALONG CONTINUOUS SLOT OF CHANNEL ..

4 ROUNDED EDGES OF NUT PERMIT EASY INSERTION. SPRING (YOUR THIRD HAND) HOLDS NUT SNUGLY IN PLACE FOR BOLTING.



5 ASSEMBLE FITTING, NUT AND BOLT—A TURN OF THE WRENCH, IT'S DONE.

UNISTRUT PRODUCTS COMPANY



# Experience is my Classroom

By T. W. REYNOLDS

## • HOW TO PAY LESS TAXES

Depreciation, maintenance and obsolescence charges—matters never too well understood or applied—loom large on to-day's horizon where taxes are high. No one wants to be taxed on a book profit which he did not have. Depreciation, deferred maintenance, and continued use of obsolete equipment, all contribute to book profit and the government. The contractor and engineer are concerned about these matters and as equally confused by the wealth of material written on the subject.

Fundamentally, depreciation is only a matter of entering the proper pro-rated overhead, so that the buyer of a product or service pays for the seller's equipment by the time it is used up and the seller knows the periodic deflated value of his plant equipment. By ignorance or neglect, equipment is often under depreciated so that its cost is not recovered in the selling price of product. Furthermore, by mistaken economy, money that might well have been spent on maintenance is deferred only to become a profit on paper. In other words, an overhead which is by error under rather than over results in undue taxes, low selling price, false profits and an inflated value of assets.

Depreciation varies with the item under consideration. A building lasts longer than its equipment, equipment longer than a truck, and some trucks longer than others due to the type of use. One contractor may do more business than some other contractor, or more than he did the year before, in which event his truck depreciates faster. The government has certain depreciation rates but will recognize longer life of equipment when fortified by the individual's experience records.

If depreciation is taken for too short a time, profits will eventually appear on the books which were not realized. Deferred replacement of obsolete equipment also serves to increase book profit and reduce actual profit. Furthermore, equipment which increases in market value should not be credited with appreciation on the books, since the real objective is to recover the money expended for that equipment. There is no profit if a truck has to be replaced with one at a higher price. Depreciation charges should also include any material in stock which is liable to damage or obsolescence. All these things should be taken into account as overhead in order to avoid payment of higher income taxes than justified and to avoid unintentional price cutting because of poor accounting methods based on a hunch.

A machine is obsolete when (1) its operation becomes unreliable, (2) its cost of maintenance and operation is unreasonable or exceeds its productive value, (3) a change in other plant equipment, processes or methods renders it unsuited to overall production, (4) a new machine may be obtained which is more productive at less annual cost due to greater machine efficiency or to less labor attendance required, or (5) the machine becomes under-capacity due to contemplated changes or increased plant output.

An old boiler should be replaced when estimates show a profit will result by the use of a new boiler which can use cheaper fuels. A machine should be replaced when (1) a new one is obtainable of more simple construction, longer life, less parts and increased standardization, (2) break down can thereby be reduced or eliminated, (3) greater accuracy, less waste and less maintenance will be obtained, (4) less lubricants and other supplies will be required, (5) greater safety against accidents, fire or explosion is insured, (6) flexibility of operation and output are increased, and (7) less space will be required. As a rule, a vertical machine replacing a horizontal one frees valuable space.

A machine should not be replaced if (1), there is no money available, (2) political or labor union pressure is against the change, (3) there is a certainty that better equipment will soon be available, (4) it is practical to condition the equipment for less costly operation, or to bring it up to capacity by providing some simple auxiliary item, such as a storage tank to meet peak loads, (5) its efficiency is due only to some insufficient or inefficient related equipment, or (6) selling prices of the product in the near future will be too low to warrant a change for some time to come.

The cost of any contemplated replacement should be further analyzed to include such items of cost as removal, less salvage value; new or reconnected trim and piping, if any; and any necessary relocation or readjustment of other equipment. Then there are still other items of cost, such as insurance, permits, social security, supervision, consultants' fees, purchasing costs, interest on indebtedness, and other attendant items. Spare parts may have to be discarded and new ones purchased. Incidentally, all such parts are also subject to depreciation.

## • MORE ABOUT SMUDGE

Referring to the item Smudge in the February issue, E. H. Stewart, Wesix Electric Heater Co. writes:

"Smudging is a problem common to all types of heating equipment. On the basis of experience and research, by ourselves and others, I am inclined to agree with your conclusions that the amount of smudging is a function of the amount of dirt in the atmosphere. We have concluded that electrostatic charges also play a very

(*Concluded on page* 130)

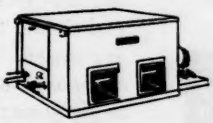
# SOUTHERN HOSPITALITY by JUNG

Architects: Weiss & Silverstein
Consulting Engr.: Weil & Moses
Mech. Engr.: Mayer Godchaux

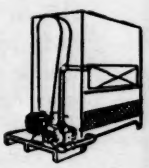
# MODERN COMFORT by Marlo

Remote room air conditioning units offer complete flexibility of installation, individual room comfort control—with no ductwork needed.

Floor and ceiling units—compact, efficient—to serve any area with complete summer-winter functions.



Marlo Evaporative Condensers and Cooling Towers can be installed indoors (don't hog the skyline) . . . and they save up to 95% of normal cooling water demand.



The Greater Jung Hotel of New Orleans, largest hotel in the South, is now bigger and better equipped —offers its guests *the best* in service . . . comforts . . . conveniences.

That's why modern Marlo Comfort Equipment was selected for its new meeting rooms — and guest rooms — in the recently completed addition.

• These Marlo units are designed to serve your air conditioning needs . . . better! Write for information on the complete Marlo line.

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MANUFACTURERS OF

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COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS
AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

(*Concluded from page* 128)

important part and that a third factor is apparently due to impingement of a rapidly moving layer of warm air over a cold surface.

"To reduce smudging, all of our radiant convection types of air heaters, including our new baseboard panels, are designed to provide a relatively slow moving layer of cooler secondary air adjacent to the wall, while the faster moving primary (direct heated) air tends to be projected into the room. Merely discharging the air through a front opening does not solve the smudging problem.

"We have also done a considerable amount of research as to ways and means of reducing or eliminating the electrostatic charges that are picked up by smoke and dirt particles when passing through the heating element. We have considerable hope that our newer heaters, such as previously mentioned, will prove to be a major step toward the eventual solution of the smudging problem.

"I would make an additional observation to your comment about the dust shadow below the ceiling beams in a residence. We have noticed this phenomenon and that similar marks appear on outside walls, especially so near points where nails are driven into the wall studs. It is much more pronounced on an exterior wall when such a wall is without insulation, other conditions remaining the same. This leads us to believe that smudging is in part a matter of condensation, air expansion and contraction, although these are not by any means the only factors involved."

## • UNIT HEATERS IN AIRPLANE HANGARS

In the January issue of HEATING AND VENTILATING in my article on heating airplane hangars, the intent of the article was to confine the subject to the controversial points of two often discussed systems (radiant versus direct fired heaters) and further to propose a combination of these two systems into one radiant warm air system. In view, however, of comments from two different sources concerning failure to include unit heaters as another method of heating, the writer would like to offer the following high lights on unit heaters. It is not intended to cover all details of this method, nor to go into all other methods and include for example, a fan duct system, but rather to inform readers who may have been misled into thinking there are only two ways of heating hangars.

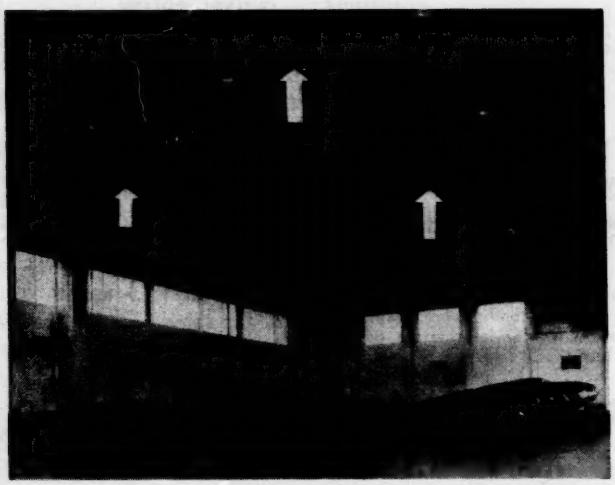

Fig. 1. Arrows show location of unit heaters in hangar at Denver, Colorado, airport.

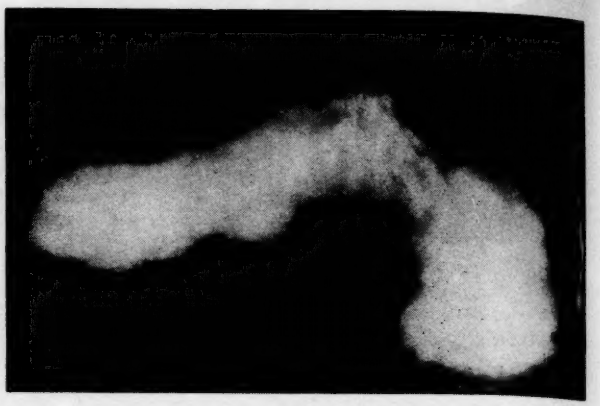

Fig. 2. One of many smoke patterns developed by a unit heater.

Unit heaters have long been used as a method of heating hangars and there are many new hangars so heated. It is a low cost method of heating. It can be used with filters; outdoor air can be delivered to pressurize and ventilate the space, and to automatically blanket exterior doors by door switch control. Unit heaters can get air down to the floor and around and under fuselages which, aside from resulting comfort, is most economical since it prevents ceiling stratification of hot air. Unit heaters can also be used in the summer months to provide cooling through movement of either indoor or outdoor air. Steam or hot water is also available for other purposes.

The Trane Co. informed the writer that they manufacture certain well known types of unit heaters to suit varying conditions and stress, among other advantages, their light weight heaters for ceiling suspension, quietness and neat appearance. Fig. 1 shows an installation of unit heaters in the Denver, Colorado airport. Although interior space is relatively small, and much glass is used in walls and doors, the space must be quickly heated when doors are closed.

Smoke patterns have been developed by the Trane Co. to demonstrate the down to floor and air envelopment characteristics to suit conditions. A heater can be fitted without an air diffuser or with one of cone-like attachment made up of fully adjustable radial louvers. The entire volume and velocity of air can be quickly changed and concentrated to increase the throw. Any pattern can be obtained at any time—a flood of heat, a gentle spread for low ceilings, one-half of the air supply to the right and the other to the left, spot heating, or close up heating without blast. One pattern is shown in Fig. 2.

A temperature equalizing system is a method of dual control which utilizes all the advantages of their design projection heater. Controlling thermostats are located for representative conditions—one elevated 5 ft above the floor to operate a motorized valve and the other at ceiling level near the heater. Day-night switches and weekly program clocks can be added.

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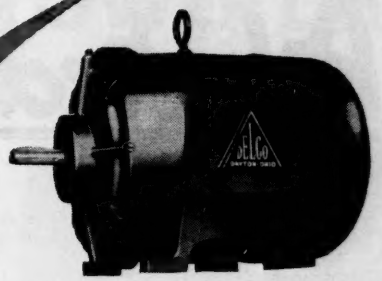
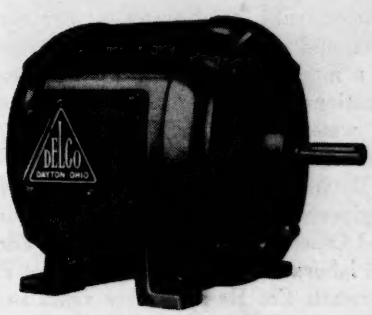
When you need motors—to serve as a *part* of your product or to help you *make* your product—look to Delco for the motors that will serve you best.

Delco produces motors for practically every known purpose . . . and each Delco motor is *engineered* for the kind of work it has to do. It's made of the finest materials, and constructed to stand up longer under the roughest conditions.

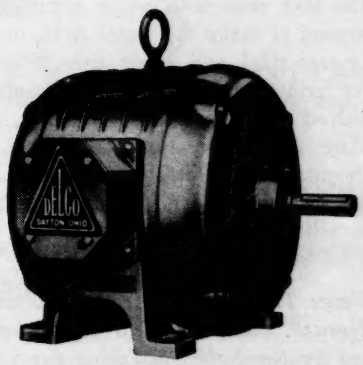
So check on Delco. You'll find Delco motors fit your needs, and that Delco always delivers on time. For complete details, write to Delco Products, Dayton, Ohio, or call the nearest sales office listed below.



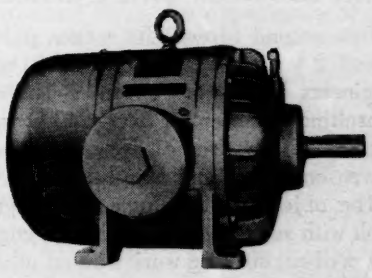
TOTALLY ENCLOSED FAN-COOLED MOTOR



OPEN BALL-BEARING MOTOR



TOTALLY ENCLOSED MOTOR



EXPLOSION-RESISTANT MOTOR

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**DELCO PRODUCTS**

**Division of General Motors Corporation**
**Dayton, Ohio**

DELCO DAYTON OHIO

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# Abstracts AND Reviews

*Publications abstracted in this department should be ordered direct from publisher.*

## WATER TREATMENT

There appears to be two important divisions of the general subject of water—water for human consumption, and water for industrial purposes. The latter factor is a most important one to those concerned with plant locations and design, the power engineer who is interested in water for boiler feed purposes, and the chemical engineer who is concerned with processes.

Detailed practical information of interest to these engineers is found in Water Treatment for Industrial and Other Uses, by Eskel Nordell, administrator, analytical laboratories, Research and Pilot Plant Divisions, The Permutit Co. He spent five years in assembling his information, although actually he brings to this book a background of over 32 years in the water treatment field.

The text deals with water impurities and methods of treatment to make the water suitable for a great variety of commercial and other uses. Some of the chapters cover industrial water supplies, dissolved mineral matter, dissolved gases, water requirements, boiler feed waters, cooling waters, aeration, deaeration, chemical feeders, sedimentation and filtration, iron and manganese removal, water softening processes, demineralization and distillation, silica removal, color, organic matter, and tastes and odors.

*Water Treatment for Industrial and Other Uses, by E. Nordell. Cloth bound, 6 x 9 inches, 526 pages. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y. Price, $12.*

## DATA BOOK FOR CIVIL ENGINEERS

New second editions have been published for Volume 1 and 2 of the three-volume set, Data Book for Civil Engineers by Elwyn E. Seelye. The author has been a consulting engineer for nearly 40 years and is the senior partner of the firm of New York consultants, Seelye, Stevenson, Value and Knecht.

The objective of Volume 1—Design, is to provide a book with sufficient data so that an engineer could design any civil engineering work without other reference books. Care has been taken to make the data simple and usable.

Included is a collection of drawings and tables that covers structures, roads, bridges, dams, sewage and water supply, and several other classifications. The second edition has such new material as a non-technical explanation of soil behavior and the application of mechanics to soils, the latest airport layouts, and late information on rigid frames, dam equipment, highways, swimming pools and industrial waste treatment.

The pages are large and the various drawings and tables are easy to read. The difficulty with many reference books is that while pages are compact, drawings of necessity must be reduced in size—often to the point where reading is difficult.

The first edition of Volume 2—Specifications and Costs, was published in 1946. The entire book was brought up-to-date for the second edition and major additions of material include specifications for the elements of an industrial building, swimming pool specifications, information on charging off obsolescence, costs for the elements of buildings, relative costs of diesel, steam and hydroelectric power. It also has information on site investigation, bridges, docks, railroads, draining, athletic fields and other structures.

*Data Book for Civil Engineers, by E. E. Seelye. Vol. 1—Design, 9 x 11½ inches, 528 pages. Price, $10. Vol. 2—Specifications and Costs, same page size, 506 pages. Price, $13. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y.*

## CODE FOR PRESSURE PIPING

Although the Code for Pressure Piping has been in use for some time, changes in materials and design indicated that a thorough revision of this code was necessary. This was done through the work of nearly 40 different engineering societies, government bureaus, trade associations, and institutes. Sectional Committee B31 made a thorough study of the material and as a result the new code has been made to agree with current practice, ambiguous material has been clarified, and there has been other important changes.

The code has been divided into seven sections covering power piping systems, gas air piping systems, oil piping systems, district heating piping systems, refrigeration piping systems, fabrication details, and materials—their specification and identification. An appendix covers fittings for instrument and control piping, and in a pocket of the back cover is a booklet on Standard Qualifications for Welding Procedure and Operator.

*American Standard Code for Pressure Piping. Paper cover, 8½ x 11 inches, 102 pages. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $3.50.*

• • •

AIR FLOW THROUGH CONVENTIONAL WINDOW OPENINGS—An extensive report on this subject (Research Report 33) was prepared by Theo R. Holleman, Assistant Research Architect, Texas Engineering Experiment Station. In this 45-page report, the author covers the question of winter and summer ventilation, drafts, window types, full scale and model testing, and air flow analysis. It contains conclusions arrived at as the result of this investigation. Texas Engineering Experiment Station, The Texas A & M College, College Station, Texas.

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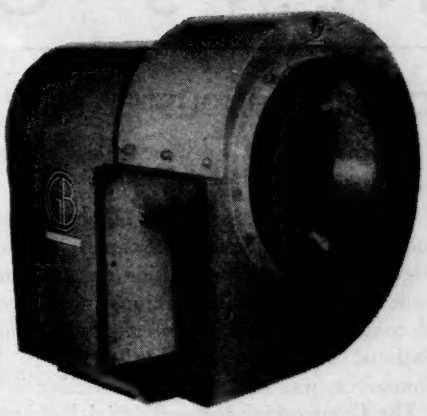

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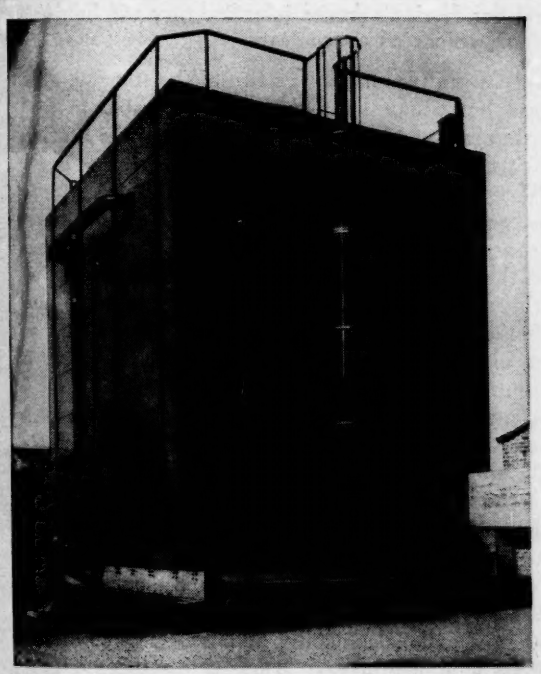

Binks Type K tower at a large pharmaceutical plant in the East.

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# NEWS OF THE MONTH

## COOLING INDUSTRY SHUTDOWN

**threatened unless more materials are allotted, advisory committee tells NPA.**

A critical situation, compelling at least half of the companies manufacturing commercial and industrial refrigeration and air conditioning equipment to discontinue operations, will develop unless greater quantities of controlled materials are allotted to the industry, the National Production Authority, U. S. Department of Commerce, was informed at a meeting in February.

The Commercial and Industrial Refrigeration and Air Conditioning Industry Advisory Committee said a survey of the industry shows that it will undergo a severe hardship unless future allotments of steel, copper and aluminum are larger than those received in the first quarter of 1952 which, compared to third and fourth quarter 1951 allotments, were substantially reduced.

• **LABOR.**—Members pointed out that very serious labor problems are arising because of production cutbacks. The industry already has stopped manufacturing certain models of refrigeration and air conditioning equipment because materials have been insufficient, members said. The industry has been trying to get other types of business to maintain production and retain their labor force, but to date these efforts have not been very successful, members said.

• **METALS.**—NPA reviewed the metals situation as follows:

(1) Steel strip is in good supply with the demand for sheets in approximate balance with allotments. Galvanized sheet is in very short supply because of the zinc shortage. The zinc supply is expected to improve slightly in March.

(2) Copper will continue to be scarce. Expanded direct military demands, increased use for industrial plant expansions and a shortage of copper ore and scrap further heighten this situation.

(3) New production of aluminum is slowly coming in. Industry representatives reported having no difficulty in placing orders for their allotments of aluminum in the first quarter.

• **LIMITATION.**—A proposed production limitation order on certain products drew strong objection. The committee said such an order, if issued, would set up an essentiality pattern and thereby would foster discrimination of one product over another. NPA agreed to consider the committee's objection.

The committee recommended that the period July 1, 1949, to June 30, 1950, be established by NPA as the base period for determining allotments of materials to the industry. Use of a six-months base period, members said, would not make allowance for the industry's seasonal fluctuations. At present the industry is allotted materials according to a percentage of their requests since consumption figures for the proposed base period are not as yet available.

• **WHO.**—A. Gordon Wootton, of NPA's General Industrial Equipment Division, presided. These committee members attended: M. Noble, Aerofin Corp., Syracuse, N. Y.; E. M. Flannery, The Bush Manufacturing Co., West Hartford, Conn.; A. J. Defino, Fedders-Quigan Corp., Buffalo, N. Y.; A. P. Shanklin, Carrier Corp., Syracuse, N. Y.; R. W. Wagstaff, The Vendo Co., Kansas City, Mo.; W. H. Aubrey, Frick Company, Inc., Waynesboro, Pa.; H. M. Brundage, General Electric Co., Bloomfield, N. J.; W. F. Switzer, General Motors Corp., Dayton, Ohio; William B. McMillan, Hussman Refrigerator Co., St. Louis, Mo.; Charles Brinkmann, Rowe Manufacturing Co., Inc., New York City; H. T. Jarvis, Refrigeration Engineering, Inc., Los Angeles, Calif.; George S. Jones, Jr., Servel, Inc., Evansville, Ind.; Orville C. Morrison, Sunroc Refrigeration Co., Glen Riddle, Pa.; W. A. Siegfried, Superior Valve & Fittings Co., Pittsburgh, Pa.; Tom Pendergast, Tecumseh Products Company, Inc., Marion, Ohio; K. W. Berkey, Westinghouse Electric Corp., Springfield, Mass.; M. G. Munce, York Corp., York, Pa.

## SUB-ZERO WAREHOUSE

**built for Florida's frozen juice industry will hold 6.5 million gallons of concentrate.**

Should the traveler to Florida tire of the state's highly publicized hot winter weather, he will be able to find immediate relief at Plymouth, a major site of the Florida frozen citrus concentrate industry.

• **GIANT.**—Here he will discover under one roof, a space that has been appropriately referred to as The Fort Knox of the concentrate industry. Next in size of refrigerated space to the three million cubic foot all-weather hangar at Florida's Eglin Field, the two and a half million cubic foot Central Florida Refrigeration Warehouse is a spectacular vault claimed to be the world's largest sub-zero refrigerated warehouse.

Sprawling in a vast open tract of land, fully exposed year-round to the tropical sun, and built to protect 6,500,000 gallons of frozen citrus fruit concentrate, this warehouse is the dream of engineer-promoter Harry Lorbach, who envisioned the need for just such a refrigerated warehouse five years ago when the industry's annual production figure was at an unspectacular 90,000 gallons. Today the production curve has sailed upwards to 30,500,000 gallons annually, and is still climbing.

• **LOAD.**—Lying within easy trucking distance of Plymouth's citrus concentrating plants, the cold storage warehouse is a low slung, single story affair with loading ramps circling three of its four solid walls. Its flat decked 100,000 square foot roof bears the full brunt of the sun. The ambient summer temperature in the Plymouth region hovers around 95F.

• **CONSTRUCTION.**—To guard against the onslaught of

(*Continued on page* 136)

*and naturally they're using

## STANDARD'S NEW

# Perimeter Floor Register

*with Standard's exclusive*
*DIALAMATIC CONTROL*

*This is it!

**Model No. PH-142**

**Works Better**

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**SPECIFICATIONS**

The face and blades of model PH-142 are fabricated of 16 gauge steel, the blades are set in a fixed-fan angle degree for even deflection. The frame is of one piece, 18 gauge steel construction. The Louvre box fabricated of 16 gauge steel. Packed one to a box, and 20 to a master carton. Comes handsomely finished in gleaming, durable metallic-lustre.

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## Air Conditioning Equipment by TYPHOON

**FROM A 1½ TON CONSOLE UNIT TO A CENTRAL PLANT**

Self-contained units
1½ to 20 tons
Multi-packaged systems
to 60 tons
Evaporative condensers
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a) chilled water
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New jobs, remodeling jobs — stores, supermarkets, offices, theatres — in fact, almost any job you undertake can be covered best with Typhoon *quality-engineered* equipment.

Typhoon works with you through its special Planning Service to design the most economical and efficient layout for every job, large or small. And through its system of Zone Control, Typhoon guarantees even distribution of cool air through the premises.

You will find as have top rated companies like RCA, ABC Television, and Whelan's Drug Stores that Typhoon's 40 years of experience pays big dividends in dependable performance, economical operation.

***The Right Air Conditioning System for the Right Job***

**SPACE SAVING SINGLE UNITS** — all Typhoon units are compact — a Typhoon 10-ton packaged unit takes up no more floor space than the average 5-ton unit.

**MULTI-ZONE SYSTEMS** — Planned and engineered so that they occupy no retail floor space at all.

**CENTRAL PLANT SYSTEMS** — Designed for maximum economy, minimum duct work.

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Specialists in Air Conditioning Since 1909

**TYPHOON AIR CONDITIONING COMPANY, Inc.** 794 Union St., Brooklyn 15, N. Y.

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(*Continued from page* 134)

solor heat the roof was covered with a 15 year bonded, 3-ply felt, pitch and slag roof applied over an aluminum foil vapor seal laid on a 2½-inch gypsum deck placed on joists 16 inches deep. These joists support wire mesh and fiber glass mats from their undersides, forming deep interstices loaded with a blown fibre glass fill.

Further protection from climatic attacks were provided by insulating the concrete walls with 8 inches thick cork curtain walls running from the ceiling to a point one foot below the building grade. It was found practical to lay a conventional concrete floor atop the usual sand fill at a level approximately four feet above building grade.

Inside, a constant —10F is held year around. This big chill is furnished by three high speed York refrigeration compressors. A fourth compressor is held in reserve.

The $1,200,000 warehouse has been leased for ten years to the Minute Maid Corp., which has first call on storage capacity for its own products. Any unused space is made available to other firms in the citrus industry who have products requiring the protection of refrigeration.

Because of the rapid expansion and accelerated growth of the fruit juice concentrate industry (26 million boxes of citrus fruit are earmarked for juice concentrates out of an expected 1951-52 production of 73 million boxes), it was early recognized by men like Mr. Lorbach that to maintain the exceptionally high quality standards the industry demanded, adequate cold storage spaces would have to be provided nation-wide; first, close by the concentrate plants, then at various critical distribution points throughout the country. The Central Florida Refrigeration Warehouse is the initial and largest single effort toward achieving these goals.

## SCHOOL REGULATIONS

**concerning heating, ventilating, and lighting in New York State amended.**

Design operative temperature of 70F for classrooms is specified in standards set forth in amended regulations of the New York State Commissioner of Education. Thermal environments for other areas are also tabulated for both heating and nonheating seasons.

Other sections of the amended regulations apply to atmospheric quality, visual comfort and efficiency, constructions plans and specifications.

• **LIGHTING.**—Under the title, Regulations of the Commissioner of Education as Amended February 28, 1952, Article 20, Section 165, Buildings and Grounds, requirements prerequisite to obtaining approval of the commissioner for plans and specifications are outlined. Following general requirements regarding plans, materials, and contracts, a section of the regulations covering visual comfort and efficiency in school building outlines views of the commission regarding natural and artificial lighting, fenestration, ceiling height, and interior color and finish.

This section is supplemented by a separate bulletin (42145 I-583) giving tentative school lighting standards with respect to minimum foot-candle requirements (20 ft-candles on desks, for instance), brightness differences, window design (i.e., any classroom to be occupied the major portion of the day by the same group of children shall be oriented so as to receive sunlight for some part of the day), classroom proportions (previous regulations are relaxed), and interior finishes.

• **HEATING.**—The portions of the regulations dealing with heating and ventilating are as follows:

(*a*) *Thermal environment during the heating season*

(1) Heating systems shall be so designed and guaranteed that when properly installed and operated they will meet the following standards.

| *Type of Space* | *Design Operative Temp.*[1]*, F* | *Corresponding Room Air Temp.*[2]*, F* |
|---|---|---|
| (a) Sedentary activity, as for example in classrooms, auditoriums, offices, cafeterias. | 70 | 68 - 72 (30 inches above floor) |
| (b) Moderate activity, as for example in corridors, stairways, shops, laboratories, kitchens. | 68 | 66 - 70 (60 inches above floor) |
| (c) Vigorous activity, as for example in gymnasiums. | 65 | 60 - 70 (60 inches above floor) |
| (d) Special cases — lockers and shower rooms. | 78 | 76 - 80 (60 inches above floor) |
| Swimming pool area. | 83 | 80 - 86 (60 inches above floor) |

[1]The operative temperature represents the mean effect of the temperature of the air of a room and of its walls. Under normal conditions walls and air exert approximately equal effects; but if a room has three cold exterior walls a higher air temperature will be necessary for comfort than in the case of a room with a single exterior wall exposed to the sun but not to the prevailing winds.

[2]The lower figure of air temperature in each case is for a room with relatively warm walls; the second figure, for a room with relatively cold walls.

(2) Maximum air temperature gradient from floor to 60 inches above floor shall not exceed 5 degrees and preferably shall not exceed 3 degrees.

(3) Air movement in zones of occupancy shall not exceed 25 linear feet per minute.

(*b*) *Thermal environment during the nonheating season*

(1) Where extensive summer use of rooms in a school building is anticipated in any area where outdoor summer temperatures are high, the Department may require the installation of air conditioning systems designed to produce inside temperature as indicated below:

| *Outdoor Temperature, F* | *Inside Temperature, F* |
|---|---|
| 80 | 75 |
| 90 | 78 |
| 95 | 80 |

(2) As an alternative to the above, the Department may require electric fans or similar apparatus which will increase turbulent air movement within such spaces.

(*c*) *Atmospheric hazards and quality*

(1) In classrooms, provision for air change shall be made which, in the judgment of the Department, will provide a minimum air change of 10 cfm per occupant.

(*Continued on page* 138)

# REMOVE Steam Trap Buying Blinders

Remove "lack of information" and "false economy" buying blinders when purchasing steam traps by sending for your copy of "Solving Steam Trap Problems" today. This book will remove the "lack of information" blinder so detrimental to trap buyers. You'll see why Anderson Super-Silvertop Steam Traps are so economical. They cost no more than ordinary traps, yet they can be serviced without removing them from the line, saving 30 minutes service time. Because of Super-Silvertop's guided bucket, eliminating bucket damage, and longer-lasting Anderloy valve and seat, there will be fewer trap breakdowns. And, with 3 pipe connections in the head, you can save up to 50 minutes installation time and 7 fittings.

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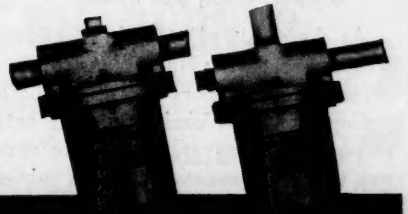


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## *because:* WHEREVER YOU ARE WHATEVER YOUR WEATHER BE IT BIG JOB OR SMALL

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. . . to sell, design and install radiant baseboard heating — in its new engineering manual No. 50-CE. Easy to read and follow this "Tell-All" book contains the only reliable certified ratings for every installation. They are both laboratory and job tested and proven.

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. . . for simple, swift installation of radiant baseboard heating, whatever job requirements. Best of all it's easy to select, order and stock. Kritzer engineering means the smallest number of parts for any given job.

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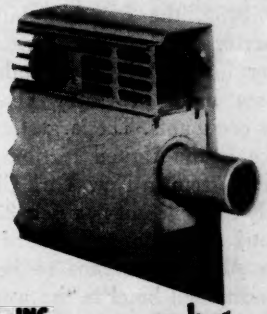

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(*Continued from page* 136)

For effective thermal operation in mild weather a design factor of 15 cfm is desirable.

(2) In rooms planned for close assembly a minimum air change of 10 cfm per occupant shall be provided in order to remove odors. Additional air change, depending largely upon wall exposure, may be required for effective thermal operation in mild weather.

(3) In rooms where there is danger of toxic substances occurring in large concentrations, or where odors are likely to be strong, or where overheating is likely to occur, special ventilating equipment adequate to relieve the situation and entirely independent of the ventilating system serving the rest of the building, shall be installed.

(*d*) There shall be furnished with the plans and specifications a brief, clear and nontechnical description of the heating and ventilating system together with instructions for operation.

## COOL OFFICES

**through Texas summer assured in 50 acres of new Dallas floor space.**

Eleven multi-story air conditioned office buildings and hotels, totalling some 175 floors and more than 50 acres of floor space have been under construction or completed in the center of Dallas, Texas during the past two years alone. Ten of them are located within a four block radius of the intersection of St. Paul and Live Oak Streets and Pacific Avenue, and the eleventh is only three blocks farther out.

• **BIGGEST.**—Giant of them is the new 36-floor Republic National bank building whose tower will rise some 600 feet into the sky. Scheduled for completion in the fall of 1952, the Republic building will have the biggest Carrier Conduit Weathermaster air conditioning system ever installed in the Southwest, with more than 2,500 room units providing year-round temperature control for occupants. The largest ever installed in a single structure is the United Nations Secretariat building's 4,000 unit system in New York City.

Next in height is a new 23-story wing for the Adolphus Hotel at Main and Akard Streets. With this addition the Adolphus claims to be the biggest completely air conditioned hotel in the world with some 1,300 weather-controlled guest rooms.

Checking in at 17 stories each and providing nearly 8½ acres of office space between them are the Corrigan Tower at St. Paul Street and Pacific Avenue and the Fidelity Union Life Insurance building at Bryan, Bullington, and North Akard Streets.

Six of the buildings bear insurance company names, including Gibraltar Life, the Great American Reserve Insurance Company, Employers Insurance, Rio Grande National Life, and Reserve Loan Life.

The list of 11 also includes the Mercantile Securities and the Mercantile Commerce buildings—both completed in 1950—across Commerce Street from each other between St. Paul and Ervay Streets.

• **CAPACITY.**—Total refrigeration to cool the 11 buildings—all of it supplied by Carrier—is 6,000 tons. Most of the refrigeration is supplied by centrifugal machines. The Employers Insurance building has three absorption refrigerating machines, which cool with steam and use ordinary water as the refrigerant.

## MANUFACTURERS' WARRANTIES

**may be in violation of ceiling price regulations unless adjustment is established with OPS.**

Authorization must be obtained from the Office of Price Stabilization before manufacturers can increase their ceiling prices by offering longer term warranties in place of, or in addition to, customary one-year warranties on their product. Application should be made to the appropriate commodity branch of Washington OPS, the agency added.

This announcement was made because of information available to OPS that some manufacturers are unintentionally violating ceiling price regulations by offering five-year warranties at new prices without first applying to OPS for approval of increased ceiling prices. Some of the violations have occurred among manufacturers of air conditioning and refrigeration equipment, the agency said.

OPS explained that the sale of a new warranty does not differ from the sale of any other new commodity or service. This is true even though the new warranty differs from previously offered warranties only as to scope of coverage or extension of time. Unless ceiling prices covering the new warranty have been established with OPS, sales on the basis of the new warranty are illegal, the agency said.

## PLASTIC PIPE

**passes Navy tests, will be used in ships to save copper, brass, and nickel.**

As the result of an eight-month sea test aboard a destroyer escort, the Navy plans to install plastic piping in several minesweepers now being built.

Copper and nickel are used extensively in present shipboard piping systems where corrosion resistance to sea water is essential. In the minesweepers where the plastic installation is planned, about two tons of copper and nickel will be saved.

In addition, there will be savings in copper-brass piping.

• **ADVANTAGES.**—The following advantages are indicated for the use of plastic piping:

Installation costs promise to be considerably less with plastics, once quantity production is begun. The cost of two-inch plastic pipe of ⅛-inch thickness will be about 70 cents a foot, while similar size copper-nickel pipe costs

(*Continued on page* 140)

# MEMO

## When to specify a Hev-E-Oil Burner

### AND CUT FUEL BILLS AS MUCH AS 20% TO 30%

In commercial or industrial installations where a burner is used to heat a building containing over 1500 sq. ft. of installed radiation . . . or when 45 tons of coal . . . or 6000 gallons of light fuel oil are used each year, fuel bills can be cut as much as 20 to 30 per cent with a Cleaver-Brooks Hev-E Oil Burner. Here's why:

The Hev-E Oil Burner is designed to save money two ways — it utilizes the heavy, low-cost, high heat No. 5 oil — it saves on the total amount of oil used. Scores of outstanding successful installations prove its economical, efficient, trouble free performance.

It will pay to investigate immediately — write today for Bulletin AD-102 and complete information — Hev-E Oil Burners are available in five sizes, 1 to 60 gallons per hour capacity, oil, gas, or combination oil and gas units.

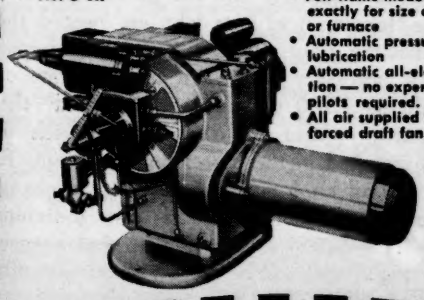
CLEAVER-BROOKS COMPANY, HEV-E-OIL Burner Division
Dept. D, 382 E. Keefe Ave., Milwaukee 12, Wis.

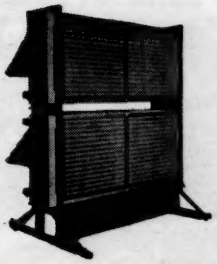
## Cleaver-Brooks HEV-E-OIL BURNER

*"The Burner Designed to Save You Money"*

For Commercial, Industrial, and Institutional Installations

- Burns low-cost, high-heat No. 5 oil
- Low fire starting
- Full-flame modulation — set exactly for size of boiler or furnace
- Automatic pressure lubrication
- Automatic all-electric ignition — no expensive gas-pilots required.
- All air supplied by large forced draft fan





20 TON

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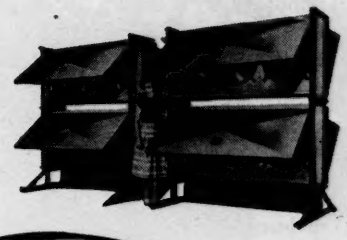
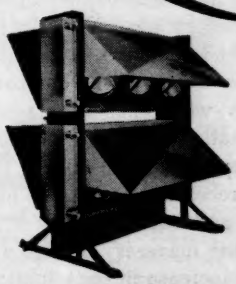


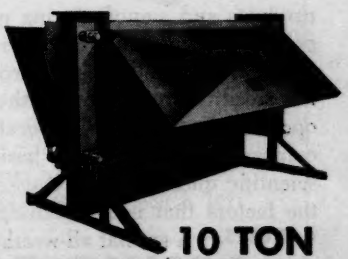
## Cut out all WATER problems WITH THE UNICON by KRAMER

The UNICON eliminates all water problems . . . because it does not require any water. Any size compressor, regardless of tonnage, can be air-cooled with the UNICON by KRAMER. Stands, hood, and wind deflectors are available for simplified outside mounting of this Remote-Type Air-Cooled Condenser.



20 TON

SPECIAL APPLICATIONS
Write to us about your condensing problem.



10 TON

WRITE FOR BULLETIN U-177-S

KRAMER TRENTON CO.
Trenton 5, N.J.

(*Continued from page* 138)

about $1.55 a foot and stainless steel pipe costs about $2.25 a foot. Black steel pipe, which corrodes and therefore is not used for sea water piping except in times of great material shortages, costs 55 cents a foot.

Maintenance costs should also be less. The tests aboard the destroyer escort have indicated that for many purposes plastics outlast metal. Even in compartments where the air was very hot the plastic pipes did not corrode or burn.

Several pieces of plastic pipe were installed just above the boiler drum, where the air temperature reached 180F. After eight months of service aboard the destroyer escort, this pipe was not affected.

Plastic pipe also does not corrode from salt water and is resistant to shock. Sections of plastic pipe carrying salt water under pressure were installed just aft of the forward guns. They remained good as new while nearby steel pipes had to be removed because they were damaged by the combination of corrosion and shock.

The chief engineer of the destroyer escort also reported that during a storm, in which the pipe was subjected to severe stress and vibration, the plastic pipe was not visibly damaged. Several metallic pipes, however, gave way.

Plastic pipe was installed in representative places throughout the destroyer escort for purposes of the test. Norfolk Naval Shipyard did the installation work under guidance of the U. S. Naval Engineering Experiment Station at Annapolis. For example, plastic fire main piping 3/16-inch thick was put in locations where resistance to heat, shock, and average salt water conditions could be determined.

## ALL-WEATHER LAB

**to study industrial toxicology, fatigue, and clothing comfort.**

Plans for construction of a new $2,000,000 Haskell Laboratory of Industrial Toxicology near Newark, Del., have been announced by the Du Pont Company.

This will provide enlarged facilities for the company's industrial toxicology laboratory which has been located at the Du Pont Experimental Station in Wilmington since 1935. The Haskell Laboratory rigidly tests Du Pont products and manufacturing processes to eliminate every potential hazard to employees and customers.

The new facilities have become necessary as this work has steadily expanded with the increase in the company's operations. The new laboratory will also enable the company to broaden its basic research on two major scientific questions: the causes of industrial fatigue and the factors that make clothing comfortable.

• **FIBERS.**—A special all-weather room at the new laboratory will enable researchers to extend and improve their techniques on one of the newer phases of its work: research on causes of fatigue among employees. It will also be used to assist the Textile Fibers Department in fundamental research on the basic factors of clothing comfort. One of the few such installations in the world, this room will provide almost any kind of weather condition imaginable. In it, the scientists will be able to maintain temperatures ranging from 20 below zero to 150 above, plus wind velocities up to 20 miles per hour. Humidity will be accurately controlled.

The same room will be used to contribute physiological studies to the program of the Textile Fibers Department on clothing comfort. This is a broad, fundamental program intended to discover why fabrics make people comfortable or uncomfortable. Du Pont researchers believe that, if they can make this discovery, they will be able to design clothing that will provide greater comfort under extreme conditions of heat and cold; that they will know how to make better fabrics and what fibers to use.

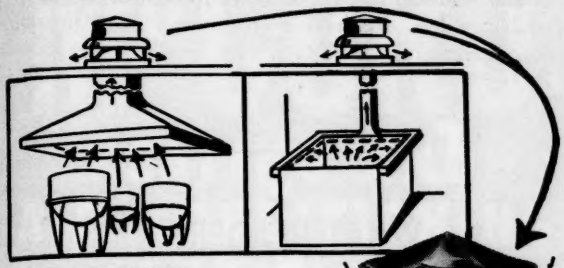
## NEWS BRIEFS

• Use of efficient, small-sized heat plants, in combination with effective house insulation, reduces substantially the amount of metal used in residential heating systems without loss of indoor winter comfort, according to the Housing and Home Finance Agency. Gaged by the size of newly constructed houses, there is clear need for more central heating units having a capacity of not more than 50,000 Btu per hour, a report on Metals Saving Trends in Domestic Heating said. As the amount of insulation increases, the maximum hourly Btu capacity needed for many houses may conceivably drop to 35,000. Research indicates that it probably would not strain the economics of insulation, or adversely affect the present marketability of houses, to strive for a practical maximum heat loss of 35 Btu per square foot of floor area where the prewar basis had been 100 Btu. In other words, a reduction in heat loss, and a corresponding reduction in heat plant capacity, to 35% of the prewar level is a practical target.

• The $70,000,000 superliner United States, now being completed at the Newport News shipyards, will be the most fully air conditioned ship of its size afloat, according to marine heating engineers. A mammoth network of 65 air conditioning systems honeycomb the 51,500-ton 990 foot liner to feed conditioned air into the 1,000 staterooms, the crew's quarters and the public spaces, report Minneapolis-Honeywell experts who engineered the job. They add that the giant size of the air conditioning system made it necessary to design five separate control systems utilizing 1,100 thermostats to provide the necessary sensitive control for the system. Each of the thermostats installed in the passenger staterooms has an extra large setting knob so the occupant can change the temperature of his room to suit his own individual requirements. The system is so complete that even conditions in the dog kennel will be thermostatically controlled, the engineers add.

(*More News Briefs on page* 142)

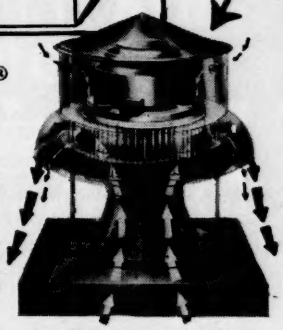
# SAFE
## Moisture and Fume Removal



**GALLAHER Air Van®**
**POWER EXHAUSTER**

Expel moisture and fumes without the danger of motor damage. Exclusive Scroll Effect design, built-in, assures efficiency against normal static pressures. Positive air seal-off prevents passage of fumes into motor housing.

Air-Vans are weatherproof and completely self contained. No penthouses necessary. Direct connected. Construction Heaviest of any comparable unit.



Pat. 2188741 2526290

Ratings tested and certified by an independent laboratory. Capacities 150-11,000 CFM Static Pressures to 1¾" Ideal low silhouette design.

**For full technical information contact your Gallaher Representative or write the Gallaher Company, Dept. V. 4108 Dodge Street, Omaha, Nebraska.**

**The GALLAHER Company**
Omaha, Nebr. Owatonna, Minn.

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# D.I.P. Solves UNDERGROUND & EXPOSED PIPING PROBLEMS

REG. U. S. PAT. OFF.

**When architects and contractors have difficult insulating problems in the conveyance of steam, hot water, or refrigerants, they most often find the answer in DURANT INSULATED PIPE.**

**Because the positive protection is always dependable and the non-porous asphalt is completely waterproof, D. I. P. will not lose efficiency with the passage of time. This long service dependability with its low maintenance costs adds to the over-all economy of DURANT installations.**

**If you do not have complete catalog information and engineering data on DURANT products and processes, we will send them on request — or you can secure them through our representatives located in principal cities over the entire country.**

REG. U. S. PAT. OFF.

WESTERN DIVISION
DURANT INSULATED PIPE CO.
1015 RUNNYMEDE STREET
PALO ALTO, CALIFORNIA

EASTERN DIVISION
DURANT INTERNATIONAL CORPN.
WILLIAMSTOWN
NEW JERSEY

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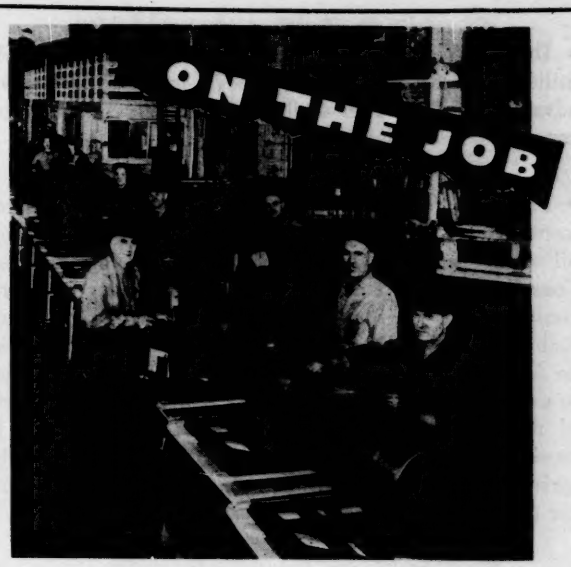
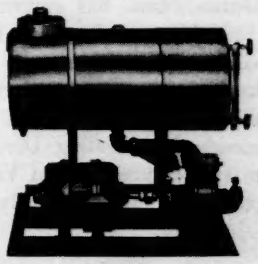



**Like the dependable Skidmore Pump, which operates under all types of conditions, the men that build them are on the job too! Day in and day out, all types of Skidmore Pumps are flowing down the production line for defense and peace time orders. Whether your requirements call for the TM Turbine type pump or the HS Condensate Horizontal type pump, these and other Skidmore Pumps are on the job, performing dependably everyday.**

**We will be glad to give you information and council on any special pump application. Write for detailed bulletin on these or any other type Skidmore Pump.**



***Send for Bulletin No. 17***
**Type TM High Pressure Turbine Pump. Pressures up to 150 lbs. and boilers to 250 H. P.**

***Send for Bulletin No. 14-A***
**Type HS Condensate Pump. Capacities from 1,000 to 65,000 sq. ft. E.D.R. Pressures from 10 to 75 lbs.**

MANUFACTURING QUALITY PUMPS SINCE 1921

# SKIDMORE PUMPS

ST. JOSEPH, MICHIGAN

(*News Briefs continued from page* 140)

• During the twelve months ended December 31, 1951, utility sales of gas rose to 48,075 million therms, an advance of 14.5% over 42,000 million therms sold in the comparable period a year earlier.

• Proposals for relieving what they called a maladjustment of East Coast prices on No. 2 domestic heating oil were discussed March 19 by members of the East Coast kerosene and distillate fuel oils industry advisory committee at their first meeting with Office of Price Stabilization officials. Members of the committee said an increase in the East Coast ceiling price is essential to assure an adequate supply of No. 2 heating oil. Officials of the Petroleum Branch of OPS said the problem is receiving careful study. They added that OPS expects to arrive at a decision by May 1 so that the pricing structure for the 1952-53 heating season can be established.

• Thomas H. Ford has been appointed engineering manager of RCA room air conditioning activities. He comes to RCA Victor from the Vilter Manufacturing Co., manufacturers of industrial refrigeration and air conditioner equipment, where he served as a sales and application engineer. For the five years prior to that he was employed as design engineer in air conditioning for the Westinghouse International Co.

• Appointment of W. L. Sneltjes as manager of sales planning of the General Electric Co.'s Home Heating and Cooling Department has been announced. Mr. Sneltjes was formerly supervisor of advertising and sales promotion for automatic heating and residential year-round air conditioning equipment for the G-3 Air Conditioning Division. He came to G. E. in September, 1950, from the Williams Oil-O-Matic Heating Division of the Eureka-Williams Corp., where he was advertising and sales promotion manager.

• Mueller Brass Co., Port Huron, Mich. has announced the appointment of Robert L. Gibbs as manager of the Wholesale Distributing Division. Mr. Gibbs who has been with the company for the past ten years, was formerly manager of field sales personnel. Tyler Riggin, formerly manager of the Wholesale Distributing Division was recently appointed executive vice president of Valley Metal Products Co., Plainwell, Michigan, the newly acquired Mueller Brass Co. subsidiary.

• International Heater Co. has announced the appointment of W. A. Matheson, Jr. as vice president in charge of sales. Mr. Matheson was formerly connected with the Perfex Corp. as Chicago district sales manager and manager of the government contract division. Prior to that he had been manager of contract sales with the Williams Oil-O-Matic Division of the Eureka Williams Corporation.

• The appointment of George E. Simons to be advertising manager of all appliances of the Crosley Division of Avco Manufacturing Corp. has been announced.

• The appointment of John C. Davidson as assistant manager of application engineering of the Airtemp Division of Chrysler Corp. has been announced. Mr. Davidson joined Airtemp in 1947 as a field engineer in the Minneapolis region. He held that position until his present appointment.

# WHAT READERS SAY

## Calculations for Humidification

EDITOR, HEATING AND VENTILATING

James Marshall's interesting article, "Calculations for Humidification," (February, 1952) brought back memories to me of my early struggles to develop a rational basis for design, using unit humidifiers and window ventilation. Having switched suddenly from the design of chain store air conditioning systems to textile mill humidification, I devoted many hours to back-to-first-principles thinking. The two main differences, from conventional air conditioning, are 1) the rate of outside air change is unknown, and must be assumed; 2) the discharge of atomized water from the overhead units must be evaporated before any droplets settle on the machines.

Various empirical methods for air change have been developed by the major contracting companies making installations of this type, but Mr. Marshall's is the first I have seen which relates it to internal heat load. His assumption appears to be that the occupants of a room will tolerate a certain degree of heat, and will open more windows as the temperature goes above that point. Not taken into account is the proportion of window area to floor area, orientation of windows to prevailing summer breezes, average summer wind velocity, etc. Any attempt to combine all these factors into an air change figure would probably be quite meaningless. In actual practice, when the temperature gets too high for the workers, they knock off for the day.

One point on which I have never received a satisfactory answer is: How much additional humidification capacity must be provided to compensate for the loss of moisture through the open windows, due to the higher vapor pressure existing inside, and in addition to the moisture carried out with leaving air on the leeward side of the building.

Fortunately this type of humidification system is rapidly being replaced by either evaporative cooling (with controlled air supply) or by real air conditioning, with refrigeration. Most of the guess-work is eliminated in these systems, and the superior results are felt to justify the increased cost.

We must be grateful to Mr. Marshall for dealing with a subject rarely discussed in technical articles, even though his solutions for the two basic problems are strictly empirical.

*H. P. Waechter, Chief Engineer*
*United Merchants Laboratories, Inc.*
*New York, N. Y.*

# McCORD

## HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS

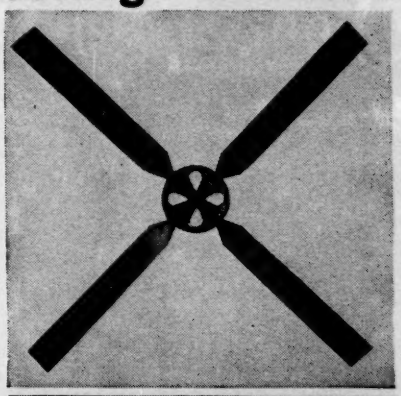
**Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.**

VERTICAL TYPE UNIT HEATERS

**A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.**

McCORD CORPORATION
DETROIT 11, MICH.

# Need Cooling FANS?



MAIL COUPON NOW
for detailed information on
*Aeromaster*
Industrial
Cooling Fans

- ***FASTER COOLING***
- ***LONGER LIFE***
- ***GREATER ECONOMY***
- ***FAST SERVICE***

Koppers Aeromaster Fans are an adaptation of high-speed, top-efficiency aircraft propellers, resulting in longer life and improved anti-flutter performance. Aeromaster's high efficiency *cuts power costs up to 10%* . . . helps fan pay for itself.

Aeromaster Fans are available for every sizable industrial cooling requirement. Standard models range from 5 to 24 feet diameter, with 4, 6 or 8 blades, and in capacities up to 750,000 c.f.m. Easily assembled by unskilled labor. Engineering service furnished for special low-pressure propeller fan installations.

Every Aeromaster Fan is fully guaranteed by Koppers Company, Inc. Sales engineers available in all principal U. S. cities, as well as in Europe.

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KOPPERS COMPANY, INC.
*Aeromaster Fans*
294 Scott St., Baltimore 3, Md.
Gentlemen: Please send me detailed information on Aeromaster Fans for

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(name and type of equipment to be cooled)

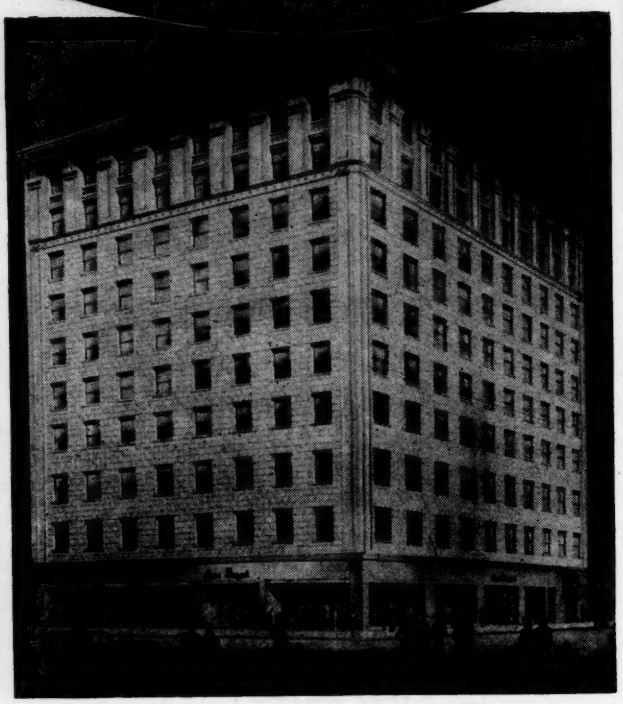
NAME .....

TITLE.....

COMPANY .....

CITY.....ZONE....STATE.....

Lane Bryant



...quiets noisy cooling tower

For over 51 years the name Lane Bryant has been a byword for progressive merchandising and good public relations in its field.

When their cooling tower installation caused objectionable noise it is not surprising that management took immediate steps to eliminate the trouble.

Nor is it surprising that INDUSTRIAL SOUND CONTROL was called upon for a solution — because ISC was the originator of industrial soundproofing.

*ISC installations, from cells for testing the most powerful jet engines to soundproofing a small compressor, have been job-proven over the years.*

Write *today* for ISC's free booklet, "Sound Facts."

***Mid-western Distributor:*** **Midwest Industrial Sound Control, Inc. 1455 North Pennsylvania Street, Indianapolis 2, Indiana.**

Industrial Sound Control, Inc.

45 GRANBY STREET HARTFORD, CONN.

2119 SEPULVEDA BLVD LOS ANGELES, CALIF.

### Value of Reversed Return

(*Continued from page* 103)

flash steam at this point to choke the discharge. Actually, while there can be none of this in a vapor system, neither should there be any material amount of flash steam in a vacuum system. Pressure drop is greatest when starting up, but traps are then wide open. Meanwhile the vacuum pump quickly frees the system of air and condensate. Therefore, the steam pressure carried and pressure drops are not high. All in all, the cost of a reversed return can be more feasibly applied to better design of the system and to the use of good traps.

The contractor's remarks about an extended receiver are not clear. We are not concerned with a trap when it is closed, nor do all traps close at the same time. Water flows back only by gravity. The vacuum does not suck or pull back the water. As for the air, this is pushed back by pressure difference as the traps open. Confusion seems to exist because vacuum is thought of as suction which in some way acts differently from pressure. If the problem is approached from the viewpoint of pressure differential, irrespective of whether it is above or below atmospheric pressure, a lot of difficulties disappear.

---

### What Would You Do?

(*Continued from page* 116)

against the operating costs of the atmospheric evaporative system.

In the shell and tube heat exchanger, the oil is circulated by the pump from the quench tank, through the shell side of the exchanger, and returned to the tank. The cooling water passes through the tubes of the exchanger and is carried away. Here again it is recommended that the temperature of the oil entering the exchanger should not exceed 165F. If higher bath temperatures are maintained, a by-pass arrangement should be employed. This will result in an increase in the quality of oil circulated.

*C. L. Ringquist*
*Air Conditioning Division,*
*The Trane Co.*

*La Crosse, Wis.*

---

• Removal of all Government restrictions on the use of lead announced in March by the National Production Authority resulted from substantially increased supplies of the metal now available to American consumers, according to a statement issued by the Lead Industries Association. In 1951 supplies in the United States were greatly reduced by the diversion of lead to foreign buyers. However, having purchased heavily in 1951 and being faced with currency difficulties now, foreign buyers no longer are willing or able to pay high prices for lead. The foreign market has receded to a point where large quantities of foreign lead are now available for export to the United States. In addition, the association said, the import duty on lead was suspended effective February 12. Meanwhile, production from domestic mines, hampered last year by labor shortages and strikes, is progressing at an accelerated pace.

# WHERE TO PUT THE BULB for HOT WATER CONTROL?

Where to put the thermostatic bulb on a storage type heater, or for controlling any heat exchanging operation, hot or cold, has always been a problem. The Aerco Heat Exchanger Control solves the problem by locating the bulb inside a tube which draws samples from the top and bottom of the tank in proportion to the rate of flow, and then mixes them inside the compensator tube. It governs and acts instantly when any water is taken off. Even when oversized the Aerco shuts off before there can be any over-ride. It controls to within two degrees on intermittent loads, and within half a degree on continuous loads up to 80% of the capacity. Capacities 5 to 300 g.p.m.

Ask for Technical Bulletin No. 22.

**AERCO**
HEAT EXCHANGER
CONTROL

**AERCO CORPORATION**
**214 Lafayette Place**
**Englewood, New Jersey**
1A

# MEET THE NEW MODEL

## MUCKLE VENTS

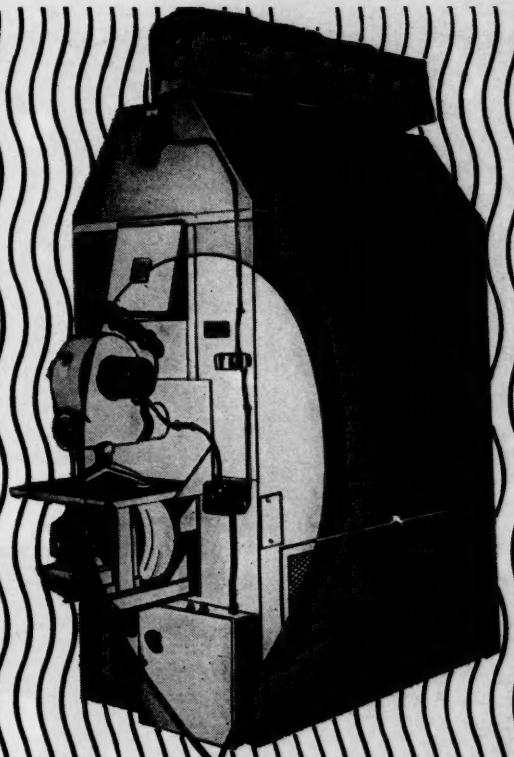
Take a look at the new silhouette .... its low slung and streamlined—better looking on any roof!

Get away from old, "eye sore" ventilators—get the newly designed Muckle Vents. Engineered for better performance in moisture-laden air—the motor is out of line of air flow. A compact, good looking, easy to install all-in-one unit to fit any roof.

Some territories open for sales representatives

Write today for more information on Muckle Vents.

Muckle MANUFACTURING CO.
OWATONNA 3, MINN.

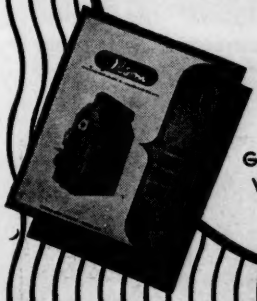


# EASY ON THE OUTSIDE

. . . All accessories are mounted outside the heater where they can be serviced without dismantling the unit. A bearing, for example, may be replaced in a few minutes without prolonged interruption of heat supply.

Olson

**ARTHUR A. OLSON & COMPANY**
**Broad Street, Canfield, Ohio**



***DIRECT FIRED HEATERS***
***Gas, Oil, Coal***
***or Dual Gas and Oil***

Get the inside story
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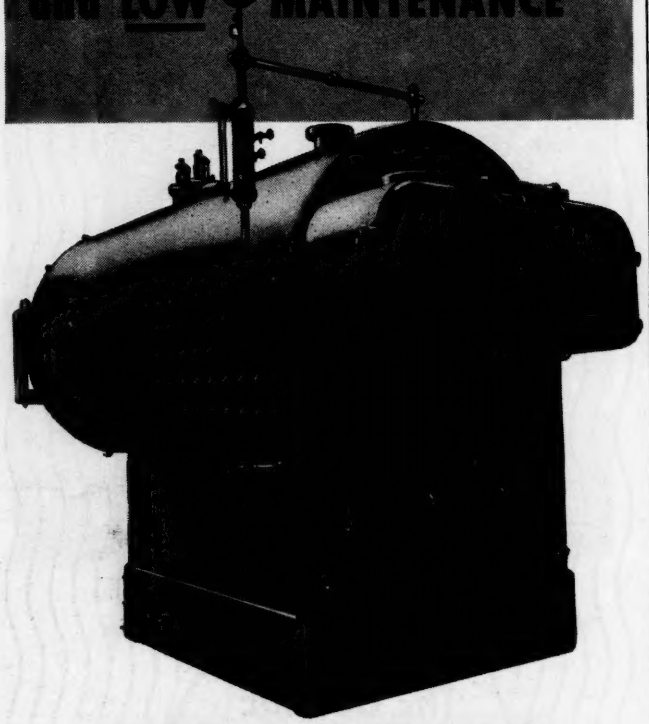
No. F50HL

All-Welded
for HIGH EFFICIENCY
and LOW MAINTENANCE



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"WP" TYPE
FIREBOX BOILERS

Write today for Bulletin B-3030

Precision die formed, fusion-welded into a single-piece unit, the sturdy Titusville "WP" Boiler is designed in every detail to deliver long-lived, satisfactory heating and power service for exacting industrial and institutional requirements. ● Investigate the advantages for your application!

THE TITUSVILLE IRON WORKS COMPANY
A division of Struthers Wells
TITUSVILLE, PENNSYLVANIA

**Canadian Degree-Days for February, 1952***

| City | February 1952** | February Normal | Cumulative Sept. 1 to Feb. 28 1951-52** | Cumulative Sept. 1 to Feb. 28 Normal |
|---|---|---|---|---|
| Calgary, Alta. | 1310 | 1355 | 7550 | 6666 |
| Charlottetown, P. E. I. | 1227 | 1238 | 5439 | 5666 |
| Crescent Valley, B. C. | 1047 | 1112 | 5841 | 5743 |
| Edmonton, Alta. | 1428 | 1501 | 8181 | 7299 |
| Fort William, Ont. | 1409 | 1582 | 7537 | 7204 |
| Grande Prairie, Alta. | 1551 | 1456 | 8552 | 7456 |
| Halifax, N. S. | 1056 | 1170 | 4548 | 5068 |
| London, Ont. | 1157 | 1240 | 5299 | 5253 |
| Medicine Hat, Alta. | 1311 | 1406 | 7146 | 6438 |
| Moncton, N. B. | 1247 | 1392 | 5728 | 6106 |
| Montreal, P. Q. | 1266 | 1460 | 5865 | 6108 |
| North Bay, Ont. | 1444 | 1492 | 5935 | 6653 |
| Ottawa, Ont. | 1285 | 1459 | 6158 | 6382 |
| Penticton, B. C. | 963 | 969 | 5136 | 4779 |
| Porquis Junction, Ont. | 1668 | 1764 | 8128 | 8064 |
| Prince George, B. C. | 1299 | 1305 | 7425 | 6677 |
| Quebec City, P. Q. | 1293 | 1481 | 6225 | 6688 |
| Regina, Sask. | 1592 | 1764 | 8484 | 8137 |
| St. John, N. B. | 1172 | 1266 | 5202 | 5652 |
| Saskatoon, Sask. | 1618 | 1635 | 8851 | 7911 |
| Toronto, Ont. | 1053 | 1206 | 4786 | 5154 |
| Vancouver, B. C. | 731 | 736 | 3964 | 3797 |
| Victoria, B. C. | 697 | 689 | 3707 | 3414 |
| Windsor, Ont. | 1050 | 1148 | 4759 | 4877 |
| Winnipeg, Man. | 1488 | 1775 | 8021 | 8091 |

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.
**February, 1952, figure covers 29 days.
The Department reports slight revisions in the figure for December, as published in last month's issue. Corrected figures are: Grande Prairie, Alta., 1922; Moncton, N. B., 1353.

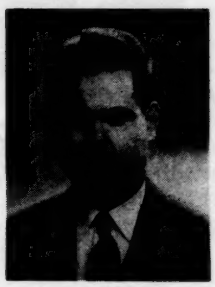
## GETTING PERSONAL

**G. B. Olson** (co-author of *Metal Processing at Subzero Temperatures*, page 83) was born in Lyrestad, Sweden.

He came to General Electric Co. in 1920 after several years experience in precision manufacturing and special studies in metallurgy at Columbia, Yale and Purdue. At G. E. he specialized in materials and processes involving metals and was head of the Mechanical Section of the laboratory when he retired on January 1, 1952.

Mr. Olson received the company's Charles A. Coffin award for "his outstanding contributions to the treatment of tool steels and in the development of special alloys." He is the author of several articles dealing with low temperature treatment of metals.

G. B. Olson



H. T. Gregg, Jr.

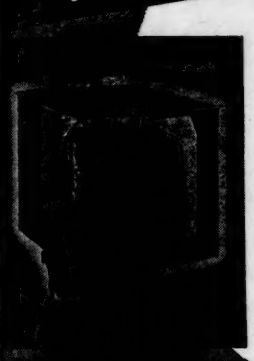
**H. T. Gregg, Jr.** (co-author of *Metal Processing at Subzero Temperatures*, page 83) was born in Richmond, Va. He is a graduate of Virginia Polytechnic Institute where

(*Concluded on page* 148)

# Sicon

High Heat-Resistant Finish

PROTECTS THIS PRODUCT AGAINST TEMPERATURES OF 870° (F.)



☆ It takes an unusual finish to withstand the constant high heat generated by the combustion chamber of the Superflame Floor Furnace, made by the Queen Stove Works, Inc. Yes, SICON lengthens the life of this unit because it does not break down like ordinary finishes due to its amazing stability under high heat. SICON is the first commercially priced silicone base finish that can be applied by brush, spray or dip and which either air dries or adapts itself to any existing force drying system.

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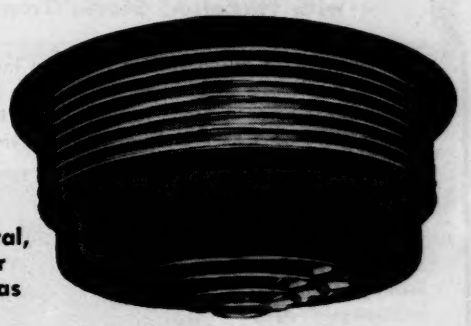
# Norman* Three-Sixty

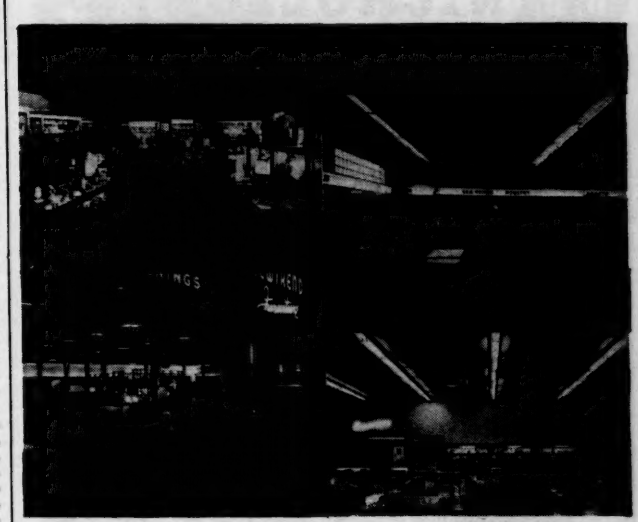
**The Unit Type Gas Heater For Modern Store Interiors**



Patent No. 2519496
Other Patents Applied For

**for natural, mfgd., or mixed gas**

New symmetrical design harmonizes perfectly with attractive store interiors. New comfort for customers and clerks. No hot spot blasts or cold corners. Heat is gently diffused by fan and convection in a full 360° radius. Fully automatic, quiet operation. Forced draft simplifies venting problem—assures expulsion of flue gases to outside. *Get the facts now.* Send for descriptive literature, specifications and name of nearest representative or distributor.



**Made by the makers of the famous Norman Southerner Horizontal Gas Furnace**

**Norman products company**

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CONTROLS PERFORM IMPORTANT RESPONSIBILITIES, AND SHOULD BE SELECTED WITH DISCRIMINATION

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THERE IS NOTHING LIKE IT IN THERMOSTAT DESIGN, CONSTRUCTION AND PERFORMANCE ✱ MOST HEATING ENGINEERS ARE FAMILIAR WITH ITS BASIC INHERENT SENSITIVITY, AND ITS NATURAL QUICK RESPONSE TO ROOM TEMPERATURE CHANGES, THEREBY ASSURING IDEAL HOME COMFORT THROUGHOUT COLD WEATHER CONDITIONS OF THE YEAR

THE REASON FOR THE MERCURY SWITCH IS THE ADDED SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE—ALL OF WHICH ARE IMPORTANT WHEREVER CONTROLS ARE REQUIRED

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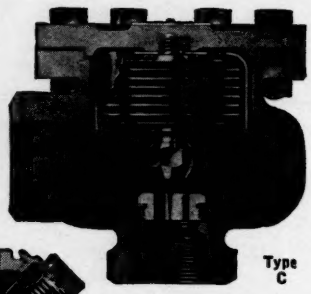
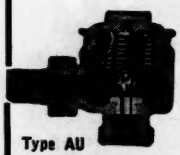
**with Nicholson Steam Traps**

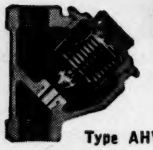
A large processor, by substituting Nicholson thermostatic traps for mechanical units, cut important drying operations from 24 to 16 hours, and refining cycles from 5 to 4 hours. They credit the higher and more even temperatures Nicholson traps effect. 5 types for every purpose; sizes ¼" to 2" press. to 250 lbs. See why leading plants are increasingly standardizing on Nicholsons.



Type C



Type AU



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**TODD SHIPYARDS CORPORATION**

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**Elmhurst, Queens, N. Y.**

TODD NEW YORK, U.S.A.


(*Concluded from page* 146)

he received his B.S. in 1949 and his M.S. in 1950.

He entered the employ of General Electric Co. in 1950 under the company's Chemet (chemical-metallurgical) program. In July of last year he joined the Construction Materials Division of G. E. where he worked with Mr. Olson on the cold treatment of metals.

He is a member of the American Society for Metals and is in the USNR.

## COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

**OIL HEAT EXPOSITION**—National Oil Heat Exposition, at Commercial Museum, Philadelphia, Pa., in conjunction with the 29th annual convention of Oil-Heat Institute of America, at the Benjamin Franklin Hotel. R. H. L. Becker, secretary, 6 E. 39th St., New York 16, N. Y. .....**APRIL 14-18, 1952.**

**OHI OLD TIMERS MEETING**—Annual jamboree of the Oil Timers Club of the Oil Burner Industry Inc., at the Lu Lu Temple, 313 South Broad St., Philadelphia, Pa., during Oil-Heat Institute Convention. H. A. Maccubbin, national secretary, 120 W. Madison St., Villa Park, Ill. ..**APRIL 15, 1952.**

**GAS APPLIANCE MEETING**—Annual meeting of the Gas Appliance Manufacturers Association at The Broadmoor, Colorado Springs, Colo. H. Leigh Whitelaw, managing director, 60 E. 42nd St., New York, N. Y. .....**MAY 21-23, 1952.**

**ASRE SPRING MEETING**—39th spring meeting of the American Society of Refrigerating Engineers at the Atlanta Biltmore Hotel, Atlanta, Ga. Secretary, M. C. Turpin, 40 W. 40th St., New York 18, N. Y. .....**JUNE 1-4, 1952.**

**NDHA MEETING**—Annual meeting of the National District Heating Association at Skytop Lodge, Skytop, Pa. John F. Collins, secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 3-6, 1952.**

**CONTRACTORS CONVENTION**—163rd annual convention of the Heating, Piping and Air Conditioning Contractors National Association at the Statler Hotel, Boston, Mass. Joseph C. Fitts, secretary of the Association, 1250 Avenue of the Americas, New York 20, N. Y. .....**JUNE 10-13, 1952.**

**ASME MEETING** — Semi-annual meeting of the American Society of Mechanical Engineers, at the Sheraton Gibson Hotel, Cincinnati, Ohio. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **JUNE 15-19, 1952**

**ASHVE SPRING MEETING**—Semi-annual meeting of the American Society of Heating and Ventilating Engineers at The Essex and Sussex, Spring Lake, N. J. Executive Secretary, A. V. Hutchinson, 62 Worth St., New York 13, N. Y. **JUNE 16-18, 1952.**

**STOKER MEETING**—1952 annual meeting of the Stoker Manufacturers Association, at the South Shore Inn on Lake Wawasee near Syracuse, Indiana. Marc G. Bluth, executive secretary of the Association, 307 No. Michigan Ave., Chicago 1, Ill. .....**JUNE 22-24, 1952.**

**TESTING MATERIALS MEETING**—Annual meeting of the American Society for Testing Materials at the Hotel Statler, New York, N. Y. Secretary of the Society, 1916 Race St., Philadelphia 3, Pa. .....**JUNE 23-27, 1952.**

**ELECTRICAL ENGINEERS MEETING**—Summer general meeting of the American Institute of Electrical Engineers, at the Nicollet Hotel, Minneapolis, Minn. Secretary of the Institute, 33 West 39th St., New York 18, N. Y. ..**JUNE 23-27, 1952.**

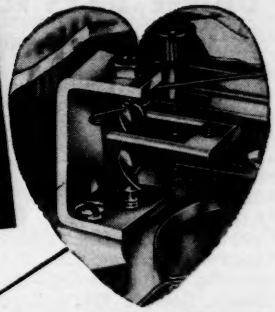
**ASME MEETING**—Fall meeting of the American Society of Mechanical Engineers, at the Sheraton Hotel, Chicago, Ill. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. .....**SEPTEMBER 8-11, 1952.**

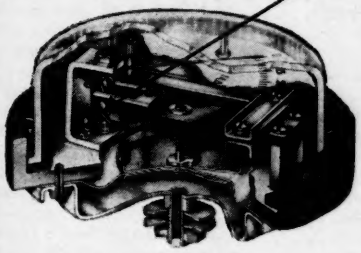
**AGA CONVENTION**—Annual convention of the American Gas Association, in the Auditorium, Atlantic City, New Jersey. Secretary of the Association, 420 Lexington Avenue, New York, N. Y. .....**WEEK OF OCTOBER 27, 1952.**

*Only*

DWYER MAGNEHELIC GAGE has the ultra-sensitive "MAGNETIC LINK"

Not subject to surge or vibration damage





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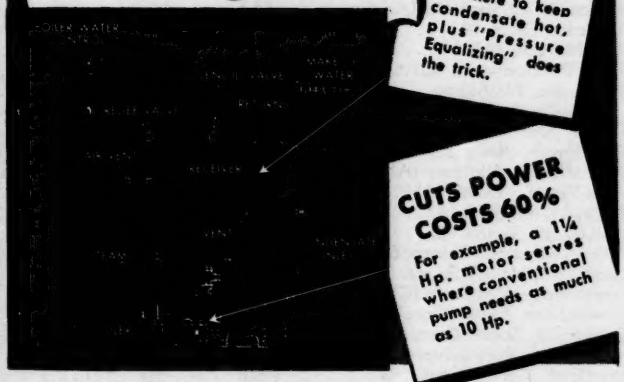

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# plain facts

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**fact 1** Although ventilators have long been selected primarily on the basis of capacity ratings, those ratings usually are based on *horizontal* wind tests only. *In actual use ventilators must perform with winds blowing at* ANY *angle.*

**fact 2** Capacity ratings of most ventilators are not certified. Performance does not equal ratings claimed in some cases.

**fact 3** Breidert Air-X-Hausters are the *pioneer* ventilators with published capacity ratings based on tests* made with wind blowing in *all* directions, as shown below.

Breidert Air-X-Hausters provide safe, sure ventilation no matter which way the wind blows (barring interior negative pressures). Stationary, no moving parts, nothing to jam or get out of order.

**Breidert Air-X-Hausters**

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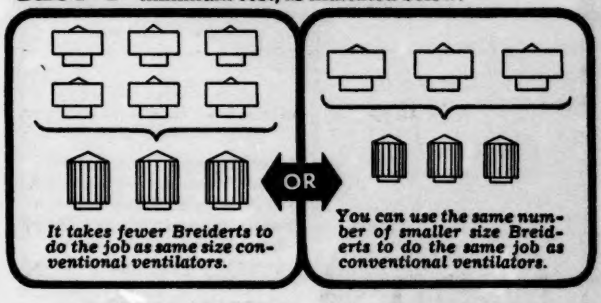
**fact 4** The Breidert delivers better results at minimum cost, as indicated below.




*It takes fewer Breiderts to do the job as same size conventional ventilators.*

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- 50,000 BTU output—Natural draft
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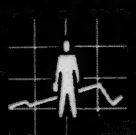

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Complete, up-to-the-minute information, sizes, capacities, and prices on all Western equipment upon request. In 1952 SWEETS and A. E. C.

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# DEGREE-DAYS FOR FEBRUARY, 1952

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 24th Year of Publication of Monthly Degree-Day Data

| City | February | | |
|---|---|---|---|
| | 1952 | 1951 | Normal |
| Abilene, Texas (A) | 356 | 425 | 510 |
| Albany, New York (A) | 1094 | 1057 | 1142 |
| Albuquerque, New Mexico (A) | 738 | 699 | 692 |
| Alpena, Michigan (C) | 1170 | 1194 | 1278 |
| Anaconda, Montana (C) | (a) | 1072 | 1164 |
| Asheville, North Carolina (C) | 613 | 654 | 756 |
| Atlanta, Georgia (C) | 459 | 484 | 557 |
| Atlantic City, New Jersey (C) | 754 | 766 | 904 |
| Augusta, Georgia (A) | 414 | 448 | 423 |
| Baker, Oregon (C) | 1147 | 928 | 991 |
| Baltimore, Maryland (C) | 681 | 759 | 843 |
| Billings, Montana (A) | 1043 | 1041 | 1120 |
| Binghamton, New York (C) | 1023 | 1004 | 1182 |
| Birmingham, Alabama (A) | 423 | 447 | 521 |
| Bismarck, North Dakota (A) | 1373 | 1517 | 1548 |
| Block Island, Rhode Island (A) | 902 | 830 | 983 |
| Boise, Idaho (A) | 995 | 783 | 848 |
| Boston, Massachusetts (A) | 935 | 841 | 1042 |
| Bozeman, Montana (C) | (a) | 1120 | 1208 |
| Buffalo, New York (A) | 1036 | 1045 | 1156 |
| Burlington, Iowa (A) | 917 | 1039 | (a) |
| Burlington, Vermont (A) | 1175 | 1186 | 1294 |
| Butte, Montana (C) | (a) | 1132 | 1143 |
| Cairo, Illinois (C) | 576 | 685 | 762 |
| Charleston, South Carolina (C) | 342 | 390 | 372 |
| Charlotte, North Carolina (C) | 556 | 528 | 588 |
| Chattanooga, Tennessee (A) | 551 | 527 | 602 |
| Cheyenne, Wyoming (A) | 1046 | 950 | 1075 |
| Chicago, Illinois (C) | 904 | 1007 | 1039 |
| Cincinnati, Ohio (C) | 728 | 797 | 862 |
| Cleveland, Ohio (A) | 947 | 976 | 1075 |
| Columbia, Missouri (A) | 772 | 844 | 897 |
| Columbia, South Carolina (C) | 404 | 426 | 498 |
| Columbus, Ohio (C) | 832 | 907 | 980 |
| Concord, New Hampshire (A) | 1163 | 1048 | 1240 |
| Concordia, Kansas (C) | 775 | 867 | 970 |
| Dallas, Texas (A) | 313 | 423 | 493 |
| Davenport, Iowa (C) | 927 | 1061 | 1140 |
| Dayton, Ohio (A) | 900 | 970 | 980 |
| Deer Lodge, Montana (C) | (a) | 1046 | 1175 |
| Denver, Colorado (C) | 865 | 866 | 918 |
| Des Moines, Iowa (A) | 942 | 1101 | 1173 |
| Detroit, Michigan (A) | 1031 | 1038 | 1134 |
| Devils Lake, North Dakota (C) | 1384 | 1593 | 1551 |
| Dodge City, Kansas (A) | 758 | 756 | 890 |
| Dubuque, Iowa (C) | 1038 | 1200 | 1218 |
| Duluth, Minnesota (C) | 1266 | 1407 | 1464 |
| Eastport, Maine (A) | 1122 | 1045 | 1232 |
| Elkins, West Virginia (A) | 854 | 875 | 991 |
| El Paso, Texas (A) | 499 | 480 | 434 |
| Ely, Nevada (A) | 1300 | 922 | (a) |
| Erie, Pennsylvania (C) | 961 | 966 | 1098 |
| Escanaba, Michigan (C) | 1202 | 1283 | 1340 |
| Evansville, Indiana (A) | 700 | 815 | 854 |
| Fargo, North Dakota (A) | 1401 | 1447 | 1606 |
| Fort Smith, Arkansas (A) | 505 | 565 | 630 |
| Fort Wayne, Indiana (A) | 951 | 1043 | 1098 |
| Fort Worth, Texas (A) | 311 | 435 | 498 |
| Fresno, California (A) | 432 | 416 | 389 |
| Galveston, Texas (C) | 159 | 278 | 255 |
| Grand Junction, Colorado (A) | 968 | 954 | 863 |
| Grand Rapids, Michigan (A) | 1004 | 1067 | 1204 |
| Green Bay, Wisconsin (C) | 1233 | 1326 | 1358 |
| Greensboro, North Carolina (A) | 646 | 638 | 678 |
| Greenville, South Carolina (A) | 527 | 543 | 661 |
| Harrisburg, Pennsylvania (A) | 822 | 877 | 1008 |
| Hartford, Connecticut (A) | 960 | 906 | 1100 |
| Hatteras, North Carolina (C) | 429 | 509 | 535 |
| Havre, Montana (C) | 1253 | 1353 | 1450 |
| Helena, Montana (A) | 1216 | 1109 | 1178 |
| Houston, Texas (C) | 176 | 271 | 277 |
| Huron, South Dakota (A) | 1229 | 1157 | 1340 |
| Indianapolis, Indiana (A) | 817 | 955 | 969 |
| Jackson, Mississippi (A) | 307 | 381 | (a) |
| Kansas City, Missouri (A) | 737 | 839 | 946 |
| Knoxville, Tennessee (A) | 560 | 581 | 666 |
| La Crosse, Wisconsin (A) | 1135 | 1292 | 1265 |
| Lander, Wyoming (A) | 1176 | 1034 | 1155 |

(a) Data not available.

| City | February | | |
|---|---|---|---|
| | 1952 | 1951 | Normal |
| Lansing, Michigan (A) | 1081 | 1110 | 1201 |
| Lewiston, Maine (O) | 1113 | 1057 | 1243 |
| Lincoln, Nebraska (C) | 846 | 933 | 1131 |
| Little Rock, Arkansas (A) | 432 | 525 | 582 |
| Livingston, Montana (C) | (a) | 932 | 1067 |
| Los Angeles, California (C) | 182 | 235 | 266 |
| Louisville, Kentucky (A) | 699 | 793 | 801 |
| Lynchburg, Virginia (A) | 678 | 702 | 730 |
| Macon, Georgia (A) | 365 | 396 | 462 |
| Madison, Wisconsin (C) | 1074 | 1221 | 1299 |
| Marquette, Michigan (C) | 1199 | 1267 | 1361 |
| Memphis, Tennessee (A) | 474 | 566 | 599 |
| Meridian, Mississippi (A) | 314 | 394 | 456 |
| Milwaukee, Wisconsin (A) | 1043 | 1213 | 1201 |
| Minneapolis, Minnesota (A) | 1192 | 1327 | 1400 |
| Moline, Illinois (A) | 967 | 1096 | (a) |
| Montgomery, Alabama (A) | 335 | 370 | 392 |
| Nantucket, Massachusetts (A) | 909 | 827 | 974 |
| Nashville, Tennessee (A) | 565 | 647 | 675 |
| New Haven, Connecticut (A) | 911 | 878 | 1011 |
| New Orleans, Louisiana (C) | 166 | 234 | 230 |
| New York, New York (C) | 821 | 790 | 953 |
| Nome, Alaska† (A) | (a) | 2226 | 1990 |
| Norfolk, Virginia (C) | 565 | 565 | 650 |
| North Head, Washington (C) | 674 | 582 | 622 |
| North Platte, Nebraska (A) | 960 | 929 | 1020 |
| Oakland, California (C) | 401 | 396 | 403 |
| Oklahoma City, Oklahoma (C) | 544 | 650 | 742 |
| Omaha, Nebraska (A) | 886 | 1008 | 1126 |
| Oswego, New York (C) | 1050 | 1079 | 1162 |
| Parkersburg, West Virginia (C) | 766 | 803 | 879 |
| Peoria, Illinois (A) | 919 | 1033 | 1067 |
| Philadelphia, Pennsylvania (C) | 752 | 762 | 881 |
| Phoenix, Arizona (C) | 281 | 230 | 263 |
| Pittsburgh, Pennsylvania (C) | 809 | 828 | 944 |
| Pocatello, Idaho (A) | 1239 | 899 | 986 |
| Portland, Maine (A) | 1123 | 1046 | 1162 |
| Portland, Oregon (C) | 642 | 559 | 644 |
| Providence, Rhode Island (C) | 915 | 807 | 1070 |
| Pueblo, Colorado (A) | 812 | 829 | 916 |
| Raleigh, North Carolina (C) | 528 | 545 | 630 |
| Rapid City, South Dakota (A) | 1102 | 1039 | 1119 |
| Reading, Pennsylvania (C) | 783 | 828 | 980 |
| Red Bluff, California (A) | 463 | 456 | (a) |
| Reno, Nevada (A) | 843 | 795 | 823 |
| Richmond, Virginia (C) | 630 | 628 | 695 |
| Rochester, New York (A) | 1050 | 1082 | 1159 |
| Roswell, New Mexico (A) | 574 | 605 | 580 |
| Sacramento, California (C) | 444 | 402 | 426 |
| St. Joseph, Missouri (A) | 799 | 921 | 974 |
| St. Louis, Missouri (C) | 701 | 801 | 854 |
| Salt Lake City, Utah (A) | 1052 | 795 | 885 |
| San Antonio, Texas (A) | 197 | 319 | 274 |
| San Diego, California (A) | 206 | 258 | 280 |
| Sandusky, Ohio (C) | 946 | 974 | 1061 |
| San Francisco, California (C) | 365 | 353 | 356 |
| Sault Ste. Marie, Michigan (A) | 1308 | 1333 | 1487 |
| Savannah, Georgia (A) | 322 | 362 | 316 |
| Scranton, Pennsylvania (C) | 949 | 928 | 1106 |
| Seattle, Washington (C) | 602 | 582 | 647 |
| Sheridan, Wyoming (A) | 1137 | 1003 | 1160 |
| Shreveport, Louisiana (A) | 310 | 411 | 412 |
| Sioux City, Iowa (A) | 982 | 1070 | 1260 |
| Spokane, Washington (A) | 1002 | 911 | 952 |
| Springfield, Illinois (C) | 802 | 916 | 1008 |
| Springfield, Missouri (A) | 699 | 750 | 876 |
| Syracuse, New York (A) | 1081 | 1101 | 1212 |
| Tacoma, Washington (C) | 651 | 615 | 675 |
| Terre Haute, Indiana (A) | 807 | 918 | 966 |
| Toledo, Ohio (A) | 995 | 1039 | 1075 |
| Topeka, Kansas (C) | 746 | 822 | 935 |
| Trenton, New Jersey (C) | 818 | 814 | 941 |
| Utica, New York (O) | 1111 | 710 | 1181 |
| Valentine, Nebraska (C) | 1038 | 1006 | 1130 |
| Walla Walla, Washington (C) | 692 | 715 | 778 |
| Washington, D. C. (C) | (a) | 725 | 848 |
| Wichita, Kansas (A) | 704 | 757 | 896 |
| Williston, North Dakota (C) | 1356 | 1514 | 1495 |
| Winnemucca, Nevada (C) | 912 | 840 | 905 |
| Yakima, Washington (A) | 876 | 838 | 846 |

(a) Data not available. †Nome data are for January.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.


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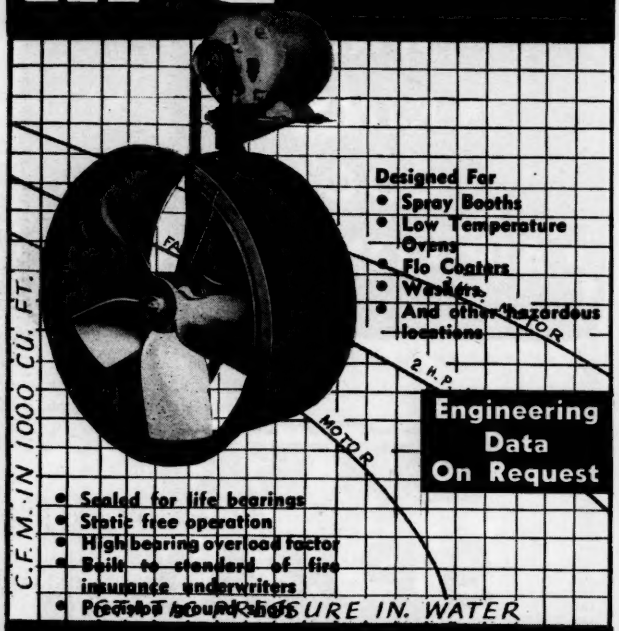


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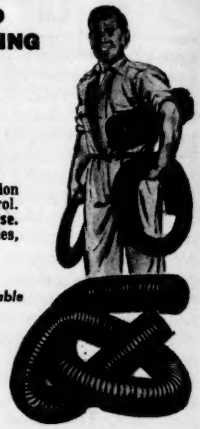

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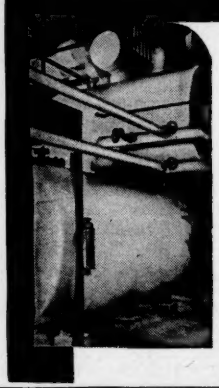

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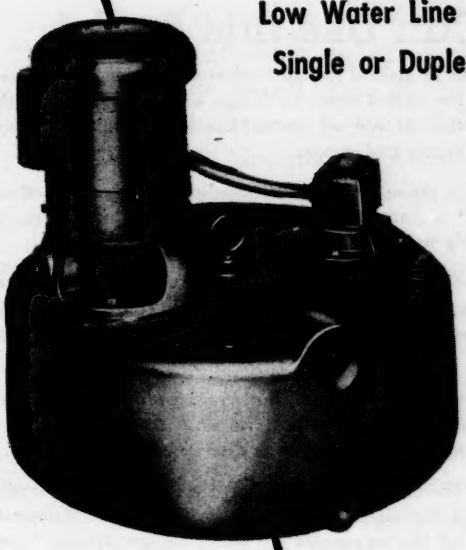

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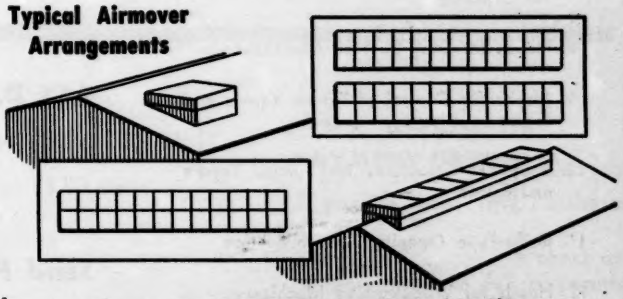

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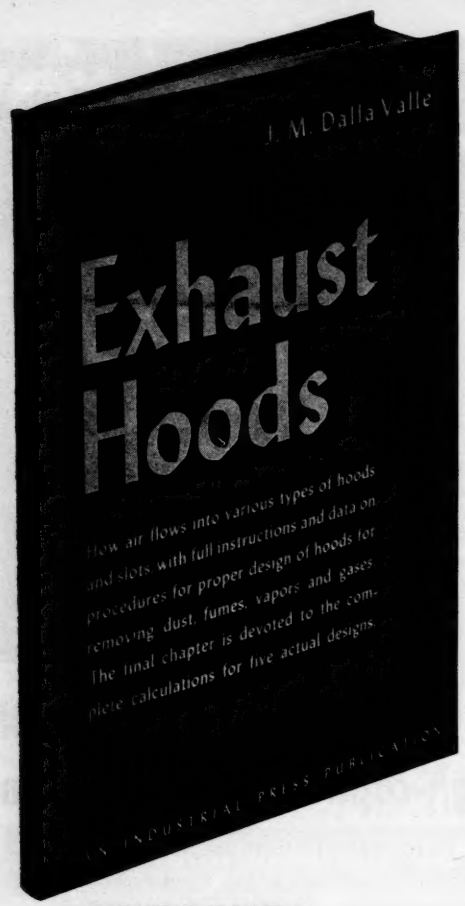
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How air flows into various types of hoods and slots with full instructions and data on procedures for proper design of hoods for removing dust, fumes, vapors and gases. The final chapter is devoted to the complete calculations for five actual designs.
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***Engineers* with occasional problems in exhaust ventilation will be able to use "Exhaust Hoods" as a means of quickly finding accurate information on a subject with which they may not be completely familiar.**

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***Teachers* of courses in ventilation, at either the university or trade school level, will find the discussion of fundamentals in "Exhaust Hoods" clear cut, and the examples of hood design applications most helpful in developing a competent background for actual work in exhaust hood design.**

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1. Theory of Flow of Gases Into an Opening
2. Velocity Characteristics of Common Types of Unobstructed Openings
3. Velocity Contours of Hoods with Special Boundary Conditions
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11. Grille-Type Openings Under Section
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**If you are looking for information on exhaust hood design, this is the only book published that gives comprehensive information on the flow of air around and into the openings, hoods, or slots in exhaust ventilating systems. Written by Dr. J. M. DallaValle, who has had over twenty years' experience in the field of industrial hygiene, it is a concise assembly of both fundamental theory (including the latest thinking along the lines of what is known as the dilution concept) and of practical applications of theory to the actual design of hoods for all types of industrial installations. Originally published in pamphlet form as a report of the author's extensive research into the subject, the basic material has been coordinated with data by other investigators covering all phases of hood, booth and slot design.**

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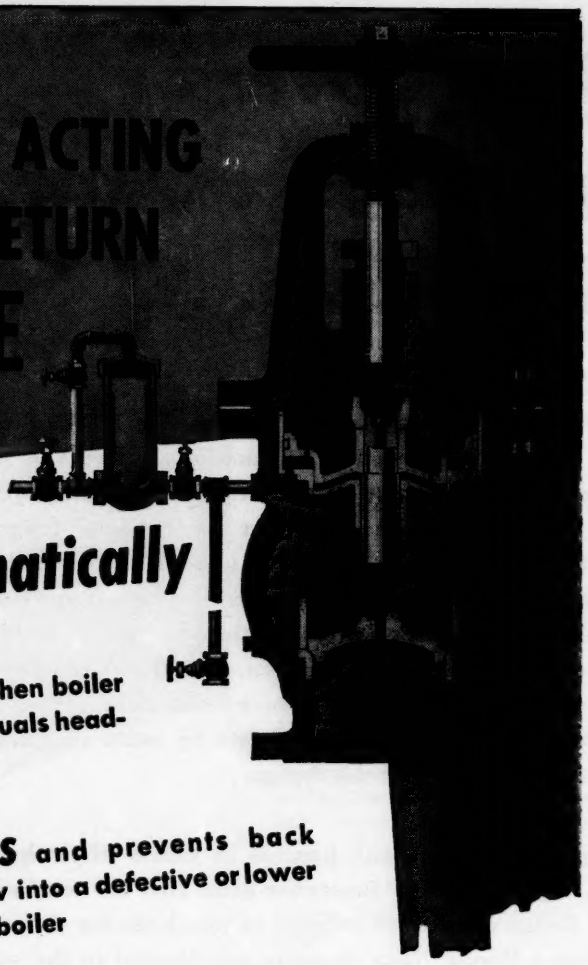

Automatically

✓ **Opens** when boiler pressure equals header pressure

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which will automatically open to cut-in the boiler when its pressure equals the header pressure and automatically close to isolate the boiler when its pressure decreases.

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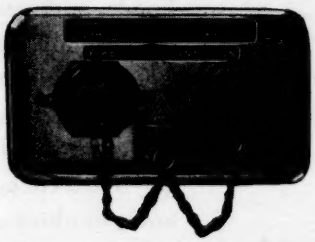

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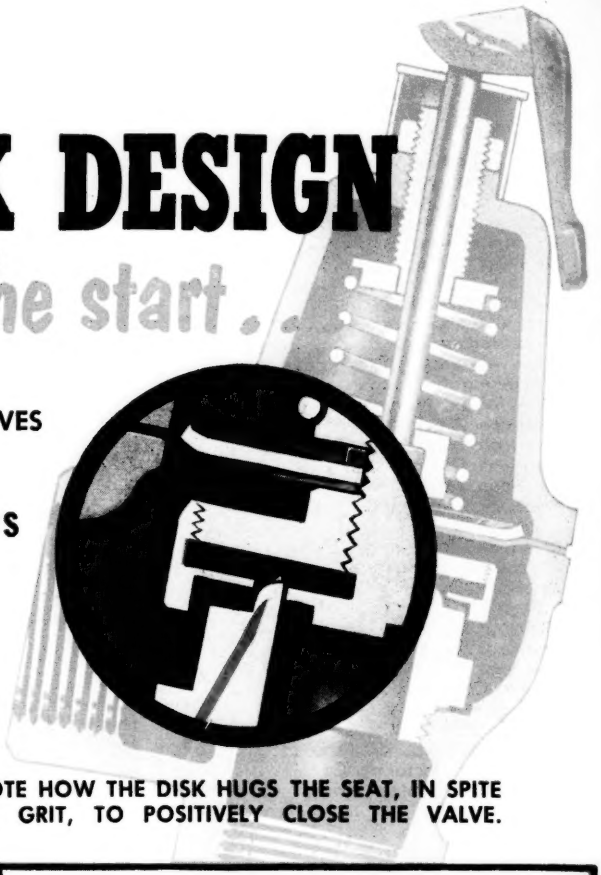
# CORRECT DISK DESIGN

## right from the start . .

**WATTS ASME BOILER SAFETY RELIEF VALVES**

## No. 74–174 Series



**NOTE HOW THE DISK HUGS THE SEAT, IN SPITE OF GRIT, TO POSITIVELY CLOSE THE VALVE.**

Although modern A.S.M.E. rated boiler safety relief valves must be capable of discharging emergency steam pressure, it must be remembered that they are **primarily water relief valves.** Steam, although possible is **unusual** and very infrequent in hot water space heating boilers.

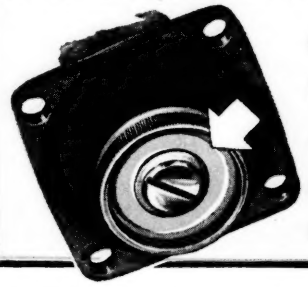
On the other hand, thermal expansion water pressure is a **normal** operating condition that occurs each time the boiler is fired. Ordinarily, the increased volume is absorbed by the expansion tank but if its capacity is exceeded, the relief valve opens to discharge—**water.**

**Watts engineers did not lose sight of this fact** when they designed Watts line of water relief valves, with a steam relieving feature, to comply with the new requirements of the A.S.M.E. low pressure heating boiler code. Right from the start, Watts No. 74 and 174 series design have included a resilient disk material which has always been the best design for tight closure and endurance in water service valves. As these facts are more generally recognized in the industry, other boiler safety relief valves will undoubtedly appear using resilient disk designs.

A tight closure is, naturally, the first engineering consideration because, obviously, a valve that will leak is a failure even before it can perform its intended function. Experience has shown valve designers that although metal to metal seating is best for steam service, it is unsuitable for dependable water valve service.

One reason for this is the fact that foreign bodies are not usually suspended in steam and therefore not apt to be carried to the valve seat. The opposite is true of water because rust, scale or grit can be carried with the flow and lodged at the point of closure. Any particle of grit caught between the inflexible surfaces of metal to metal seating prevents a perfect closure. Further, a small scar on highly polished metal surfaces is all that is needed to start a permanent leak—erosion will do the rest.

**Several years ago** Watts material research department found that Silicone Rubber had ideal characteristics for the disk requirements of our No. 74 and 174 series.



- **POSITIVE SEATING.**
- **EXTREMELY LOW WATER ABSORPTION.**
- **ABILITY TO WITHSTAND HEAT UP TO 500°F.**
- **NON-VULCANIZING.**
- **LOW COMPRESSION SET EVEN AT HIGH HEAT.**

However, this matters little to the G.E. Silicone Rubber disk in all Watts A.S.M.E. rated safety relief valves. Its high resilience allows the disk to simply envelope a particle of grit or erratic contour and still maintain a tight closure. At the next opening, grit is washed away and the disk resumes its original shape. The Silicone Rubber disk will safely stand up during periods of emergency steam pressure that a valve may encounter in service.

**Watts No. 74 and 174 series were the first to offer complete pressure protection for nearly 100% of all hot water heating boilers with a single valve and the first available in a complete range of sizes from ¾" to 2" inclusive and with correspondingly higher rated B.T.U. steam capacities.**

**Dollar for dollar, no other valve can match the design superiority Watts A.S.M.E. rated safety relief valves—they are priced right!**

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LAWRENCE, MASSACHUSETTS

**Plumbing and Heating...Safety Valves and Controls**

# THERMAL CAPACITY OF WARM AND COLD AIR DUCTS

The graph (see reverse side of this sheet), with illustrative examples explaining its use, enables the user to determine either the heating or cooling effect obtained for a given area of duct, room temperature, supply air temperature, and air velocity, or, if the heating or cooling effect, room temperature and supply air temperature are known, to determine the duct area or air volume needed. It was designed by F. W. Hutchinson and the late B. F. Raber of the staff of the University of California, Berkeley, Calif.

Whether for summer air conditioning or for comfort heating, the primary purpose of a duct system is to provide transportation not for air, but for energy. In an air conditioning system the duct carries heat *from* the occupied room, whereas in a comfort heating system the objective is to carry heat *to* the occupied space, but in each case the effectiveness of the duct depends on its ability to convey an adequate quantity of useful energy between the heat sink (as an evaporator) or the heat source (as a furnace) and the occupied space. Thus, evaluation of the thermal effectiveness and the thermal adequacy of any duct system depends only on a knowledge of the *quantity* of heat which can be either released or absorbed by the working substance (air) which flows through that duct.

In actual practice many considerations, such as noise level, power requirements, and fabrication cost, will influence the size and type of duct which is selected. Thermally, however, the system can be judged good or bad, adequate or inadequate, solely from a determination of the quantity of energy which it transports. The intent of the accompanying graph is to present a simple graphical method of checking the thermal capacity of duct systems, whether for warm air or for cold air, for use by the designer in obtaining a rapid check on his overall design, and for use by the operating engineer in readily converting his basic test data to thermal terms.

The graph permits direct evaluation of heating-or cooling-effect from a knowledge of the velocity and temperature of the air within the duct and the duct cross-section area in square inches. By arbitrary selection the base scale, expressed in Btu per hour, indicates the quantity of sensible heat present in air at the selected temperature over that quantity which would be present *if the air were at zero degrees Fahrenheit.* Thus, if air were flowing at 1,200 feet per minute through a 7 in. × 8 in. rectangular duct, and if the air temperature were 90F, the quantity of heat carried in the duct could be obtained by entering the base of the graph at area of 7 × 8 = 56 square inches and rising vertically (see dashed example line) to intersection with the radial for air velocity of 1,200 fpm; from this point move horizontally to the right to intersect the radial for 90F, then drop vertically to the lower base scale where the thermal capacity of the system is read as 43,000 Btu per hour *above zero F.*

With accuracy more than satisfactory for average engineering application the graph can be used directly to determine the thermal capacity of a duct system relative to any room delivery air temperature. Thus if air at 160F were flowing at 1,200 fpm through a 56 square inch duct and if this air were delivered to a room at 70F the amount of sensible heat introduced by the incoming air would be determined by the same procedure as in the previous example (and using the same dashed example line on the graph) except that the radial temperature line on the graph is now interpreted as temperature difference (160 — 70) = 90F between duct air and room air. Thus the heating effect is 43,000 Btu per hr. If the air flowing in the duct is at a temperature lower than that of the room the graph is used in exactly the same way (with radial lines showing temperature difference), but the answer read from the scale marked heating effect is now the *cooling* effect of the incoming air. For example, using the 56 sq in. duct, 1,200 fpm, with air flowing at 60F and the room air at 90F, the temperature difference is 30F and the cooling effect is found to be 16,000 Btu per hour.

An added volume scale, shown at the left side of the graph, permits either determination of heating effect directly from volume, or determination of volume from known duct size and air velocity. For the examples already discussed the method of volume determination is as shown by the dashed example line leading to the left.

Methods of use of the graphical solution are reversed for testing and for design. The test engineer knows temperature, velocity, and duct size by measurement, hence he uses the graph in the manner shown by the dashed line. The design engineer, on the other hand, knows the required heating effect—by calculation—and usually knows the permissible air velocity as determined from noise considerations; he therefore uses the graph to determine the volume corresponding to a selected temperature difference or the required duct area corresponding to a selected temperature difference. In other cases the graph can be used to determine the heating or cooling capacity of an existing duct system in terms of various values of the air temperature (or temperature difference) and of the duct velocity.

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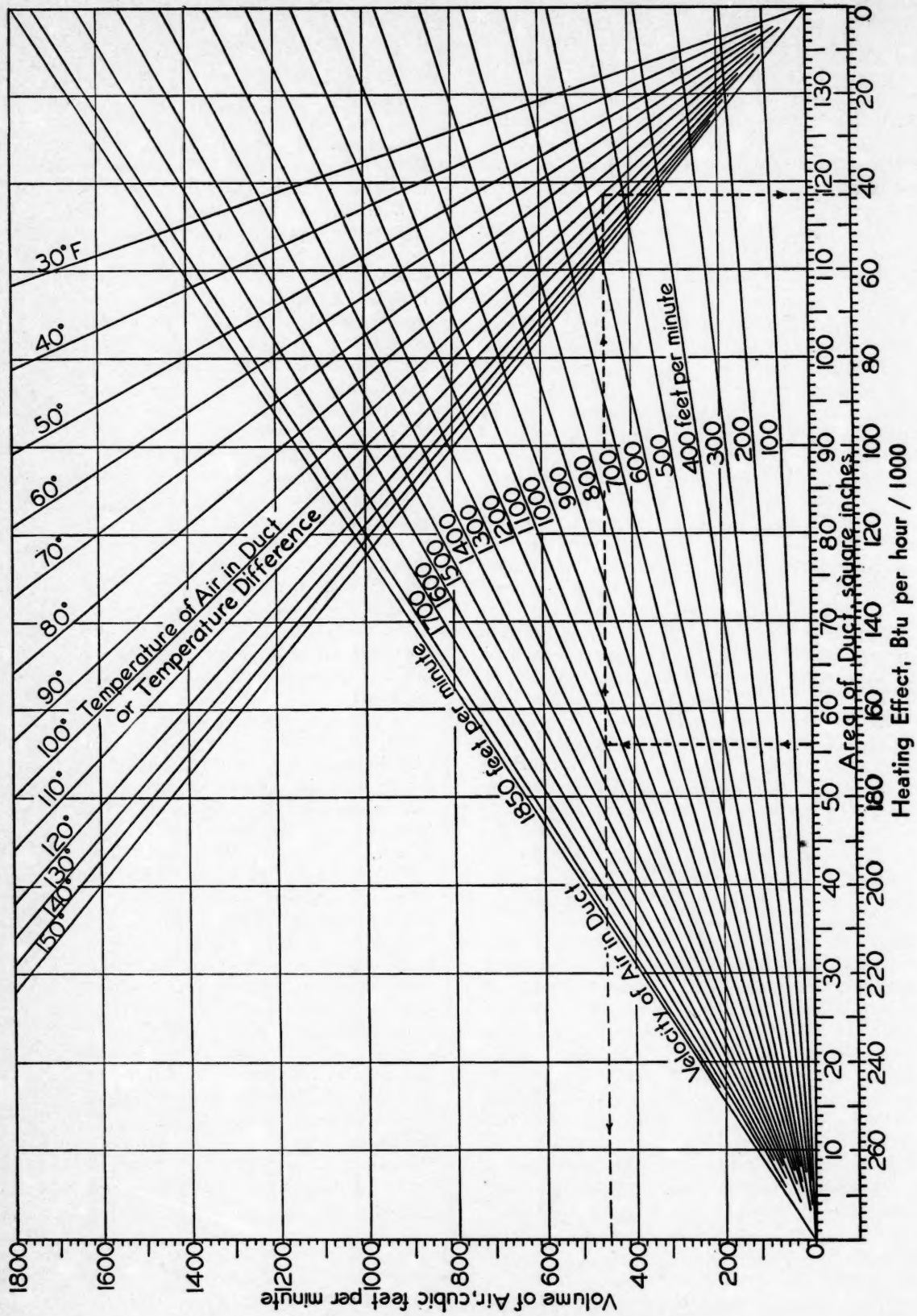
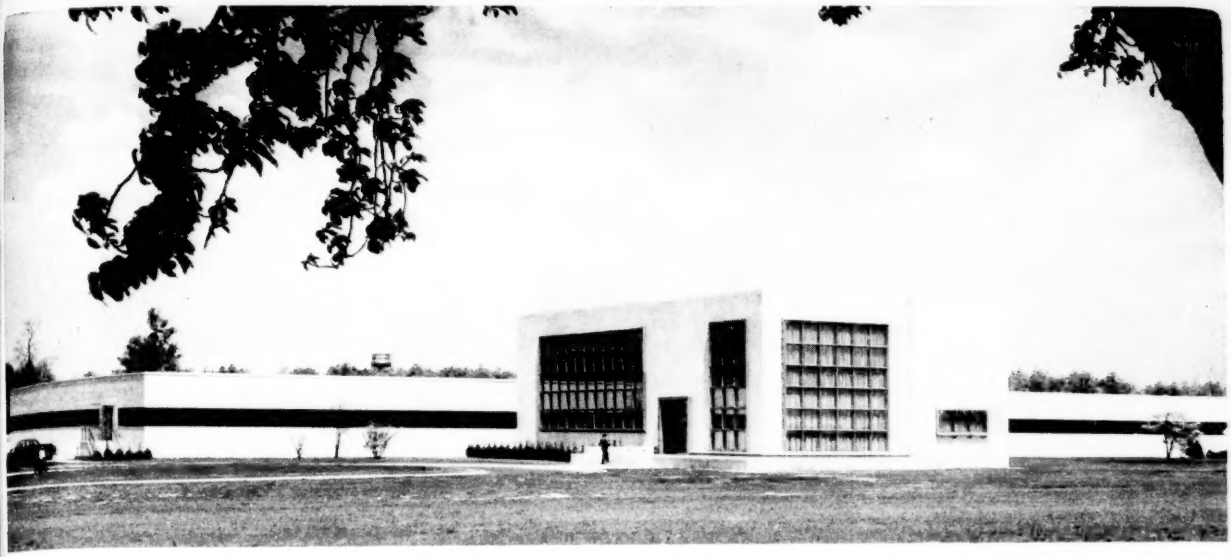



HEATING AND VENTILATING'S REFERENCE DATA

April, 1952



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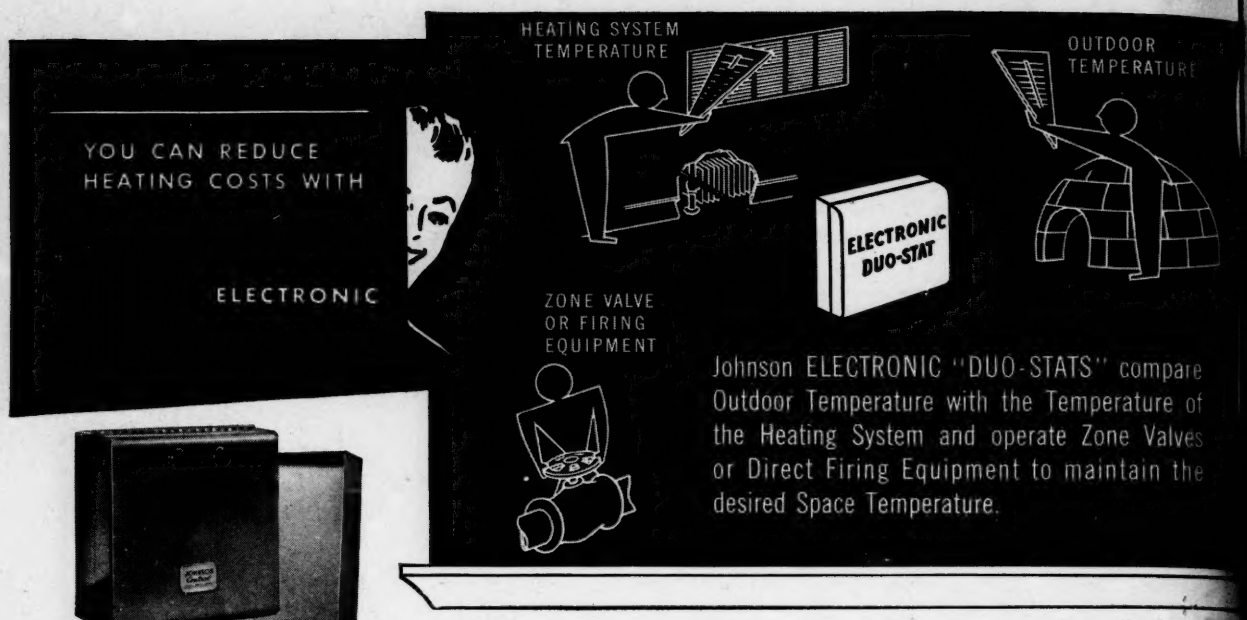

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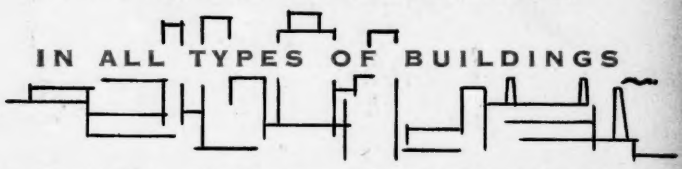


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